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CHEMICAL & METALLURGICAL ENGINEERING

JULY, 1943

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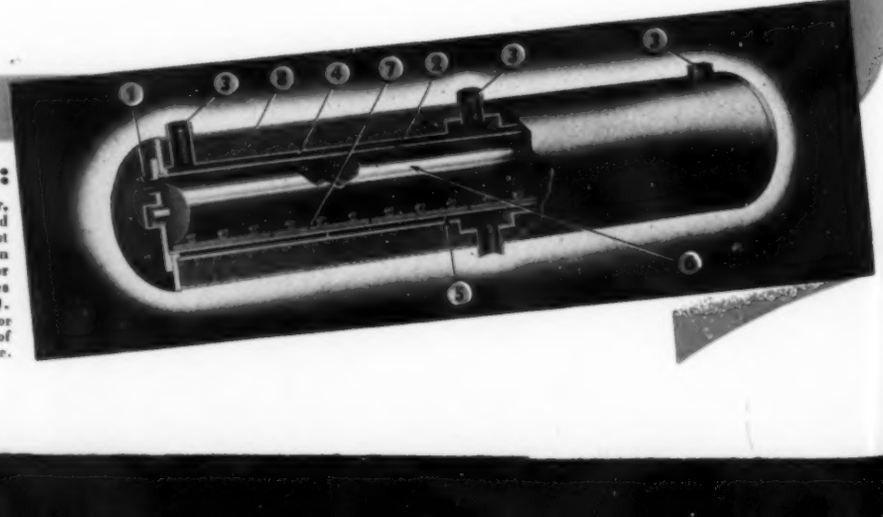

HOW THE VOTATOR WORKS:

The heart of the Votator, the heat transfer cylinder, illustrated at the right how the product is pumped in connection (1) thru annular space (2) and out connection (1) at the opposite end, depending upon the direction of flow desired. The heating or cooling medium enters at connection (3), passes thru annular space (4) and out connection (3). Mutator shaft (6) with scraper blades (7) is motor driven, causing blades to scrape film from surface of heat transfer tube (5) hundreds of times a minute.

E. Engin.
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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1908

In this Issue

JULY, 1943

Volume 50 — Number 7

Reconverting Our Surpluses 95
EDITORIAL FOREWORD

From Auto Bodies to Bomber Noses 98
By SIDNEY D. KIRKPATRICK

Butyl Rubber Production, Unique American Development ... 102
By JAMES A. LEE

Butadiene From Petroleum 104
EDITORIAL STAFF REVIEW

New Data on Activated Bauxite Desiccants 107
By R. G. CAPELL, R. C. AMERO and J. W. MOORE

New Approach to Continuous Reactor Design-I 111
By A. BROTHMAN, A. P. WEBER and E. Z. BARISH

Applications of Buna-S 114

Determining the Density of Mixed Acids 115
By CLYDE McKINLEY

Hexamine For Block Busters 116

Plastic Pipe For Rectifiers 117

Centrifugal Separation 119
A *CHEM. & MET.* REPORT

Butyl Rubber Production at Baton Rouge 132
A *CHEM. & MET.* PICTURED FLOWSHEET

Chem. & Met. Plant Notebook	118	From the Log of Experience	166
Process Equipment News	127	Personalities	171
Chemical Engineering News	139	Meetings and Conventions	175
News From Washington	142	News From Abroad	186
Readers' Views and Comments	146	Chem. & Met. Bookshelf	199
Interpreting Washington	149	Chemical Economics and Markets	213
New Products and Materials	155	New Construction	222

An index to advertisers will be found on page 370

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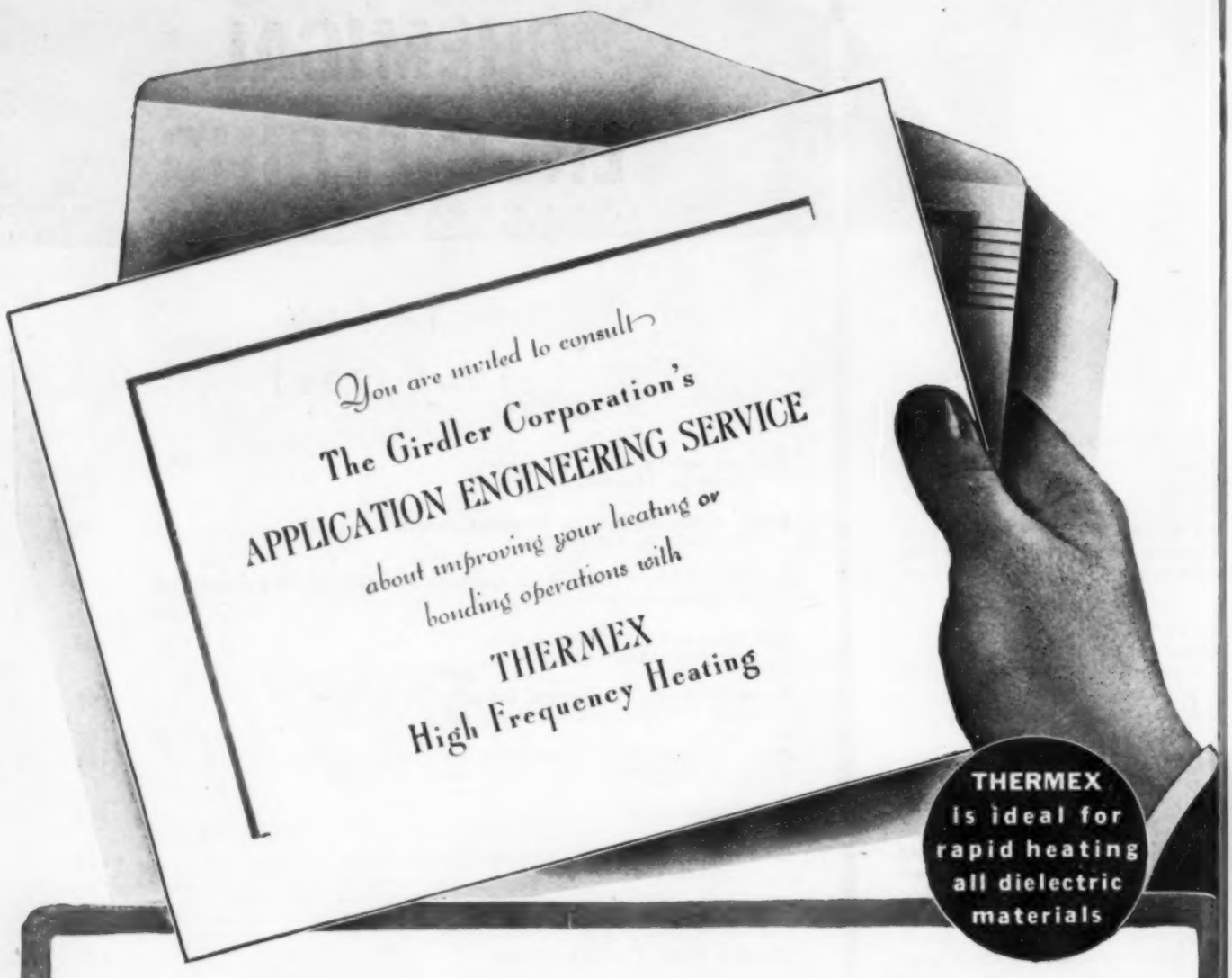

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In war, as well as in peace, the design engineer is the vital link between the inventive mind and the mass-production reality

IT IS gratifying and interesting to note that reports of new "secret weapons" not only have reversed their course during the past few months . . . they also have increased in frequency. Once they filled us with dread and misgiving. Today the enemy does the worrying.

Word about the latest new Army weapon reached us as this was being written . . . a 2½ ton truck that performs on water as well as on land with equal efficiency. "The Duck", resembling an overgrown amphibious jeep, is particularly suited to landing operations where docks are lacking. Loaded with 20 fully equipped soldiers or their equivalent in supplies, its propeller runs it ashore. It climbs the beach on its six-wheel drive and continues the trip on land.

This important addition to our "second-front" fighting equipment, coming so closely on the heels of the now famous tank-killing "Bazooka", is one of many history making contributions of American design engineers — the men who transform nebulous ideas into practical realities — the men who make our war machines superior to those of our enemies.

Invasion and eventual victory became a certainty as soon as America's design engineers threw their full effort into the war against aggression. Adapting intricate ordnance designs to mass production, these men developed weapons such as the M-10 destroyer of Rommel's tanks and brought out the new fighting planes and bombers that have won the air superiority that has turned the tide against the Axis. Taking ideas and giving them form, selecting the materials of construction, deciding upon the method of fabrication, adapting the electrical and mechanical parts that power the product, specifying the finish that protects and beautifies it . . . these men are the focal point of American production. Their ingenuity has no parallel. Once they put automobiles on a mass production basis and within the reach of all. Today, after less than three years and with little previous experience in armament design, they have brought America's war weapons to the highest efficiency . . . surpassing Hitler's weapons despite all the vaunted scientific wizardry of the Germans and their ten year start.

At this point it is well to remember that while Germany's military might is traceable to its superiority in armament, many of the basic technological discoveries (including the airplane and the submarine) are the products of American genius. The Germans always have been aware of the military advantages of technological superiority and have forced its expansion with all their might. They knew that mobility and surprise play a decisive role in modern warfare and their design engineers were kept busy, with unique intensity, to achieve unprecedented results in fast-moving, hard-hitting fighting equipment. Our own military and industrial engineers did not go into action until it became certain that we would be involved in the conflict. But even before our country actually embarked on its Preparedness Program they were busily engaged in developing the designs of our war equipment. Tanks, planes, guns, ships and hundreds of other apparatus and machines of war were studied. Carefully selected committees of our national engineering societies were organized under the leadership of the Army Ordnance Department to serve as advisors and consultants in the development of advanced designs of tanks and other motorized equipment of war. The above mentioned "Duck" and the now famous Sherman tank are just two of the many results of these efforts.

After the Preparedness Program had officially been launched and Congress had made its initial appropriation, it was necessary to create the manufacturing blueprints from which the engines of war could be built. Because the designs of the machines of production, as well as the designs of the products themselves, determine the speed and economy with which anything can be manufactured,

This is the thirteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

the capacity of our industrial system is dependent, to a considerable extent, upon the ability and ingenuity of American design engineers. Germany's military might was successfully mechanized because Germany, for more than 10 years preceding the war, was riding the wave of a world-wide technological revolution. This revolution was as far-reaching as the advent of the electric motor and the internal combustion engine. It was born of the profusion of inventions and discoveries since the last war. German design engineers took advantage of every one of these.

If we are to defeat our enemies and if we are to continue to play the leading role in the post-war world we must make better use of the new technology than do our enemies. The job is up to American product engineers who already have made tremendous strides in designing the intricate machinery of production and of war equipment. Much remains to be done however.

It has been said that the Germans have not developed one single item that can be classified as basically original, nor are there indications that any so-called "secret weapon" will henceforth be developed by them. Today the Nazis are completely outclassed by the tremendous manpower of engineering brains that is at the disposal of American industry. Although we were faced by the same fundamental problems of shortages in materials, manpower and time, our engineers not only solved these problems quickly and effectively, but they outstripped the enemy by the preponderant weight of talent which we were able to bring to bear upon our problems. As is evidenced by studies of the designs of captured German war equipment, our airplanes are faster, carry heavier loads, have superior protective armor and heavier armament. Our tanks, especially the Shermans, stand unmatched. Our tractor-mounted artillery excels theirs in fighting power. Our automotive vehicles are the envy of the world. Our battleships are supreme. Our signal and detection devices are frustrating all of our enemies' attempts to dominate the seas.

And as we approach the end of the conflict, the pattern of which already has been set, the forces that converted American industry from peace to war-production will again be brought into play, and the product engineer will continue to be the fulcrum. Our post-war industry will grow from his blueprint. Nor will his job be any less urgent, any less responsible, any less sweeping in its effects than were his efforts during the war-preparedness program.

Since the cessation of the manufacture of peace-time goods, many new materials and production techniques have been developed. Plastics, synthetic rubber and magnesium in the field of materials were relatively new and restricted in their uses when war came. So were powder metallurgy, induction heating, electrostatic heating, adhesives for joining metals and compressed resin-impregnated wood. The new possibilities in product design created by the electronic devices and applications developed during the war period virtually stun the imagination and the "atomic revolution" promises to change the entire pattern of manufacturing operations.

Never before has there been so much speculation about the future as there is today. Looking forward, who can doubt our limitless capacity to continue our industrial world leadership?

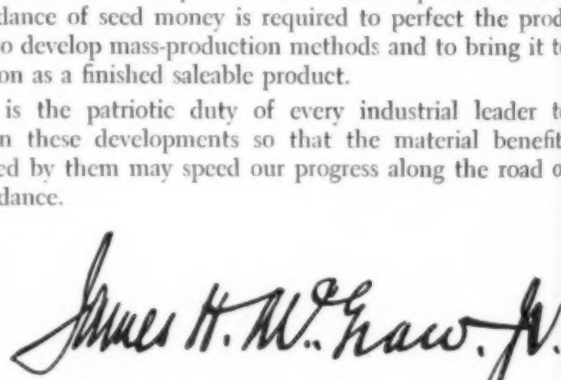
While no one can predict developments in product design in the post-war period, certain it is that they will be so vastly different and so far superior to existing designs that they will obsolete most products as we know them today. With engines of vastly superior metals, designed to burn 100 octane gasoline and built to a precision ten times greater than that of pre-war engines, our post-war automobiles will give from 40 to 60 miles to the gallon. Tires will last from forty to fifty thousand miles. The comfort and smoothness with which these cars of tomorrow will glide along are undreamed of today. Polaroid windshields will eliminate the glare of oncoming headlights and the driver will need to give but scant attention to the manipulation of his simplified gear shifts.

According to no less an authority than Igor Sikorsky, we stand on the threshold of a new air age in which the helicopter will contribute to the greatest prosperity we have ever known.

Prophecies are hard to make at a time like this but speedy house building seems to be a certainty in the world of tomorrow. Air conditioning, new methods of heating, humidifying and drying, promise to be necessities in the post-war home. Vacuum sweepers will be much lighter, less noisy and easier to manipulate. Washing-machines will be fully automatic and practically free of noise and vibration. Not only will our homes and most of the furnishings be of radically new design, but so will the factories and machines that produce them.

Only one factor can prevent the fulfillment of the dream of the product designer. His job is not accomplished over night. To convert sound ideas into production blueprints involves a great deal of time and money. The building of test models is an expensive and tedious procedure. An abundance of seed money is required to perfect the product, to develop mass-production methods and to bring it to fruition as a finished saleable product.

It is the patriotic duty of every industrial leader to hasten these developments so that the material benefits created by them may speed our progress along the road of abundance.



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CHEMICAL & METALLURGICAL ENGINEERING

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JULY, 1943

S. D. KIRKPATRICK, *Editor*

RECONVERTING OUR SURPLUSES

RECONVERSION is a complicated economic and technical, as well as political, problem. Despite the protests of the Army and the natural opposition of W.P.B. to any diversion of materials from their primary war uses, this is a problem that now warrants careful and realistic appraisal. We are in a total war which demands more than just the production of arms and ammunition. If we neglect essential civilian supplies such as food and clothing, drugs and medicines, fuels and certain consumer goods, we may well be threatening the success of our armed forces abroad. Therefore, let us consider, in this light, some of the reconversion problems that most directly affect the chemical industries.

It is common knowledge that our tremendous emphasis on war production during the past two years has resulted in surplus supplies of several important chemicals and metals. Some of these have been relatively scarce until just recently so no plans have been made to care for unexpected surpluses. The problem now is how they can be used to best advantage in the total war effort, having in mind the need for a better balance between military and essential civilian needs.

Consider some of the possible benefits that might come from discreet replanning of the use of the excess parts of our production of ammonia and nitric acid, methanol, chemical cotton, magnesium and vanadium. For example—

(1) Release of ammonia and ammonium nitrate for more general usage will greatly aid in food production by increasing the availability of nitrogenous fertilizers. Nitric acid, at a price, could stimulate important new chemical activities now held in abeyance.

(2) Freedom to use chemical cotton and cotton linters may significantly increase the production of high-quality rayons for industrial as well as certain civilian uses.

(3) Release of more vanadium would greatly aid the steel industry, perhaps having the effect of increasing mill capacity. Use of vanadium can also ease the steel-plant labor problem.

(4) Methanol can now be made in abundance, especially if more of the synthetic ammonia capacity is so converted. The result would be an abundant supply of a satisfactory anti-freeze and a solvent that could often replace ethyl alcohol. This in turn would ease the alcohol-for-rubber program.

(5) There is already assurance of more than enough magnesium for aircraft and incendiary uses. By release of some of our surplus inventory, the development of certain light-metal products could be stimulated. These in turn might ease the demand for other metals such as aluminum and certain alloy steels and perhaps replace some of the plastics that are in such great demand.

These five examples are selected from the scores that deserve serious attention not because they are necessarily the most important. Rather it is because they emphasize the fundamental principle that our wartime controls should not be so rigid as to preclude prompt and logical diversions whenever unwieldy surpluses develop. We believe that it will benefit the nation to start right now in reestablishing the supply of important civilian goods that can be made from these and other available surpluses which are now in military hands. Strengthening the civilian economy will not only restrict inflation and benefit public morale, but will actually help our armed forces in meeting the needs placed on them by the populations of the allied and liberated countries. The use of these materials to give a broader base for industrial activity will increase efficiency in the war industries themselves.

The alternate course is either continued stockpiling or temporarily closing down of the plants. The latter practice has been followed by the Army in the case of some of the TNT plants and has been threatened, even in the case of ammonia. After the war is won, an idle munitions plant in stand-by condition may

prove a good insurance policy but while the fighting is actually going on, we would probably all prefer to have these plants in production. Their outputs would then be immediately available should the "fluidity of war" suddenly develop new and enlarged needs. Meanwhile if their excess production is diverted to civilian requirements, there will be a sharing of overhead and lower net cost on the goods purchased for military uses.

It almost goes without saying that these reconversion problems cannot be handled as if the war were already won. There is a lot of difficult and bloody fighting as well as harder work and longer hours ahead of us. But there are some logical shifts in emphasis and direction which can and should be made in the direct interest of the war effort. The job is to divert excess materials and plant capacities from strictly military production into important channels where the same goods are badly needed. This does not mean a letting down of the bars for civilian luxuries or non-essentials. Nor is it an unpatriotic challenging of military needs and the war production program. Rather, it is a plea for an overall reappraisal of our total needs and surpluses and a plan of reconversion where changes can best serve the war effort.

SHAPE OF THINGS TO COME?

VICE-PRESIDENT WALLACE, who has been quoted as saying that a postwar tariff on rubber would be equivalent to declaring a third World War, would likely approve of the sympathetic views held by Dr. Earl N. Bressman, director of the Inter-American Institute of Agricultural Sciences, newly established at Turrialba in Costa Rica. In an interesting and somewhat objective discussion of "Rubber—Natural or Synthetic?" this eminent plant pathologist holds that the future of rubber depends upon the outcome of scientific competition between the industrial research laboratories and the agricultural experiment stations. "No single development holds more potent possibilities than the race between the chemist and the agricultural scientist to supply the expanding needs of the Machine Age for rubber and to supply it cheaply and abundantly."

With such statements we cannot take serious exception. Later in his discussion, however, the good doctor seems inclined to prejudge the results of the race by assuming that even with the benefits expected from chemical research, the price of synthetic rubber will have to be around 30 cents a pound when derived from petroleum and 40 cents for the same product from grain. He writes: "Even if the raw material were to cost nothing, it seems illogical to expect that synthetic rubber could be polymerized out of either alcohol or petroleum in a city factory, paying high taxes and wages, overhead, etc., at a price comparable to that involved in the production of natural rubber, which is an ideal small-family industry. It is to the interest of rubber consumers in this country to see that the rubber of the future comes from a really cheap source. In the future it should be possible with fully matured plantations of high yielding trees to produce rubber at 10 cents a pound or less."

Substitute "plants" for "plantations" and "processes" for "trees" and that last sentence comes nearer to our expectations than the 30 and 40 cent estimates Dr. Bressman previously cited. We also find it difficult to refrain from commenting on the "city factory *vs.* small family industry," especially when we read further along that—"The good wages which rubber production brings to the small family unit providing them a cash income to supplement the living they get off their place, helps to develop contented rural populations. Contented rural populations will undoubtedly mean much more to the future of this hemisphere than some synthetic rubber factories run under high-tariff protection."

Perhaps we are still too narrow and provincial in our thinking to visualize all the benefits of the great global basis on which Mr. Wallace and a few other idealists would have us operate in the years to come. But we do know something of the temper of the American people and how difficult it is going to be to take away their high wages in order to promote contented rural populations elsewhere in the world.

ROSTER TO AID ON CHEMICAL DEFERMENTS

MACHINERY has been set up in the National Roster of Scientific and Specialized Personnel to assist the chemical industry and profession in the proper handling of cases where draft deferment of technical personnel is in question. No blanket deferment is sought, which is a good thing. But an effort is being made officially to assist in holding for industry, colleges, and other institutions those scientific and engineering workers in the chemical field who are rendering a greater service there than they would be able to give if put in uniform.

The need for highly trained personnel of this sort grows steadily. The problems of intensive effort on production and the necessity for research and development work at high speed are gradually being recognized by the military as well as by the civilian authorities. It is essential that individuals and employers cooperate in putting into most essential work those persons who ought to be held out of the military service. This is a patriotic, not a selfish, duty at this time.

Employers who have difficult problems with local boards should immediately communicate with the Committee on Chemists and Chemical Engineers, National Roster of Scientific and Specialized Personnel, Washington, D. C. The facts regarding the training and experience, as well as the duties and responsibilities, of each individual should be sent in. Of course, only cases which can not be handled effectively with local boards need this treatment. But there may be some cases in which the local boards or even State appeal boards will not understand this situation without some assistance from Washington.

Not every case submitted will be supported. But a competent advisory committee is being organized and really skilled personnel is already working with the Roster to make discriminating decisions in the public interest. It is up to the chemical industry and profession to take advantage of this assistance.

GETTING READY TO BEGIN

BUILDING war factories is nearing completion. Except for the balance of the aviation gasoline program and facilities for new explosives and weapons the big job is about over. This releases for other purposes important construction equipment and many skilled persons who do not seem to be longer needed for their ordinary function of building structures and plant facilities. How best can these men and machines be used now?

The government itself recognizes this problem. At least by implication it suggests that industry should avail itself of the experienced services of these architects, engineers, and construction groups. The suggestion does not go so far as to imply that new civilian construction is expected to start immediately in many places. But it is not too soon to prepare drawings and specifications for construction work that will be needed in the early future.

The War Production Board itself says on this subject: "Through this procedure applicants can familiarize themselves with currently permissible types of construction and materials and avoid unnecessary delays resulting from redesigning projects and from the submission of incompletely prepared applications."

Farsighted management will be disposed to go even farther and to see that this business of engineering planning should also concern itself with postwar reconstruction. Even those enterprises now deep in war manufacture cannot afford to forget altogether a study of the routes by which they must eventually get back to peace-time operations.

WASHINGTON HIGHLIGHTS

CORN PRODUCTS will be very scarce unless the government finds ways in which to supply adequate corn to wet grinders making starch, sirup, dextrose and other sweeteners. The desire to hold corn on the farm for animal feed has seriously reduced market supplies to the point that several of the largest processing plants are actually shut down for lack of raw material. One Mid-Western commentator accuses the O.P.A. of "feeding the pigs but starving the babies." The baby starving, of course, relates to the fact that millions of infants need corn sirup as an essential part of their baby-food formulas. But many industries are also beginning to feel the effects of this shortage of materials which has developed from the corn-hogs situation.

STARCH SHORTAGE threatens to embarrass a number of process industries. Recently the paper industry was ordered not to use any tapioca flour for beater, surface or tub size. It is a question whether these paper makers can get enough cornstarch to serve as an alternative. There are no governmental regulations; but the supply is very inadequate for these and numerous other industrial uses. So long as the farmers have an artificial high price for hogs and a low ceiling on corn they will feed the corn instead of sending it to market to be made into starch, sirup and other urgently needed industrial products.

NITROGEN used in fertilizers this year will be about 40 percent greater than in any previous year. This is the estimate made by joint study of experts in the government and the National Fertilizer Association. Thus, the chemical industry which provides the nitrogen products for this huge fertilizer effort is contributing directly to the program for increased food production in the United States. It is greatly to its credit that during wartime it can not only supply the nitrogen needs for explosives and war industries but also make this huge contribution of the most essential fertilizer element for the farm program.

AMMONIUM NITRATE must be used more for fertilizer purposes this year than is normally desirable. We have this compound and do not have the preferred ammonium sulphate or sodium nitrate. Chemical enterprise has the task of working out ways in which the ammonium nitrate can be used both for separate application and in fertilizer mixtures. Caking caused by the hygroscopic nature of this compound cannot be wholly avoided. Nor is all element of risk eliminated during wide distribution, and possible careless handling, of this ingredient of high explosives. But with proper precautions and intelligent application serious troubles should not develop from the enforced use of this relatively less desirable fertilizer component.

MOLASSES SHORTAGE which threatened alcohol manufacture for months is now pinching on several other chemical industries. An attempt was made to relieve this situation by arranging that beet-sugar molasses be used for yeast, citric-acid, lactic-acid, and other fermentations without first removing the sugar by the Steffens process. An ill-considered order to this effect by W.P.B. had to be immediately withdrawn because it corrected one trouble only to cause several more serious problems. This shows how the interlocking of various chemical process industries must be fully understood before changes are imposed. Otherwise an arbitrary order, like this one, may do more harm than good.

HIGH-STRENGTH RAYON is now used for automobile and other tire cord to the extent of about 100 million pounds per year. But the government is perhaps a bit optimistic when it reports that at least two-thirds of that amount of additional high-strength rayon can be made with existing equipment now used for other purposes. The important point is that military demand stimulates increased production which will eventually lead to larger industrial uses of new products.

"DEGREE OF ESSENTIALITY" of various industries may be judged by the sort of preferential treatment they have been accorded by O.D.T. in allocating the diminishing supplies of gasoline available throughout the Eastern States. It is not surprising that high preference is given to those chemical process industries engaged in making essential war products. If you want to find out the relative standing of the different sorts of enterprises, study the official lists of who gets gasoline and who goes without.

PACKING is being greatly improved by the necessities of wartime. Now we have packages that can safely be given severe weather exposure and rough handling that formerly would have wrecked both the container and its contents. This experience, if we are wise, should help us learn how to use new methods and materials for postwar packaging of chemicals and related products.

From Auto Bodies to Bomber Noses

SIDNEY D. KIRKPATRICK *Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

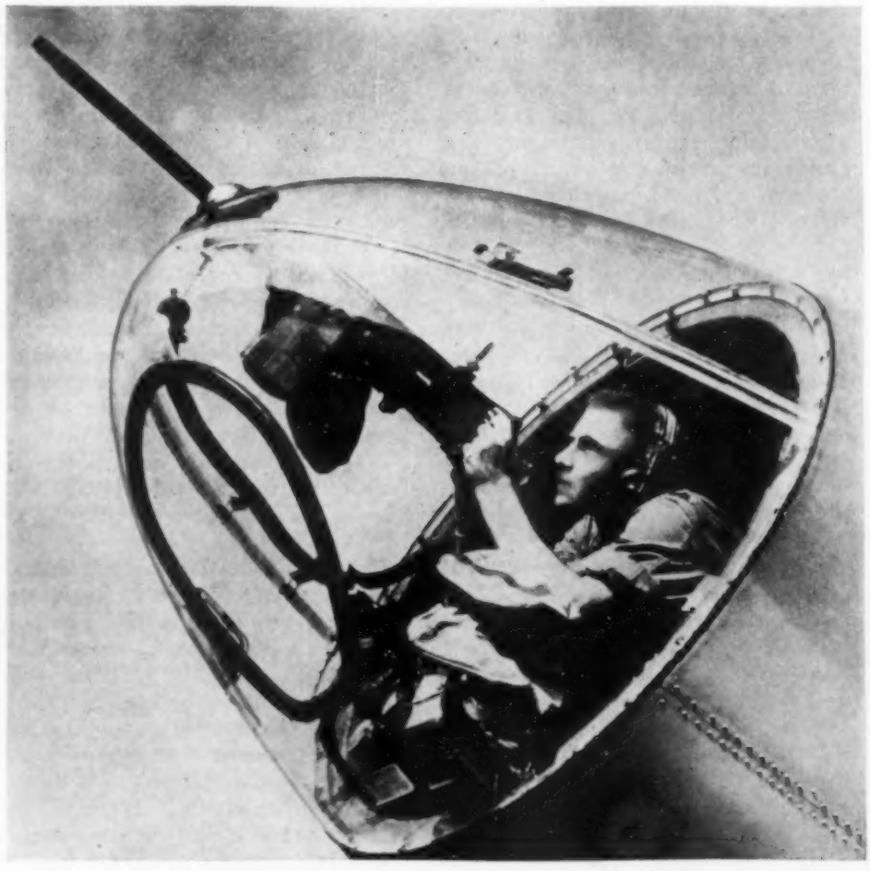
Chemical ingenuity as well as engineering of a high order were required to convert the idle buildings of a 25-year-old wood-working plant into efficient facilities for the manufacture of the transparent acrylic plastic needed for our rapidly expanding aircraft program. That this was accomplished in minimum time with maximum use of salvaged materials and reconditioned equipment is a record of which the officials of the Defense Plant Corporation are exceedingly proud. They applaud this as a challenging example of what war industry must do more frequently in the future if we are to make the most of what we have left in time, materials and machinery.—*Editors.*

THERE WAS A TIME when chemical engineers boasted of their shiny new plants, with stainless steel and chromium-plated equipment and burnished aluminum and copper accessories. Today the real hero is the man who can do most with what he has left. The real achievement in war-time plant construction is the maximum use of salvaged material and reconditioned equipment, housed, if at all, in buildings that require the minimum of critical materials. Such an accomplishment is to be seen in the Knoxville, Tenn. plant of Rohm & Haas, which is now producing an ever increasing supply of transparent Plexiglas sheets for bomber noses, gun blisters, and turrets, and for cockpit enclosures of combat planes. Chemical engineers of that company, with the help of construction engineers of the Austin Company, have quickly converted an idle wood-working plant into modern manufacturing facilities for chemicals and plastics.

Last fall Rohm & Haas, as agents for the Defense Plant Corporation, took title on 18 acres of land and about 20 wood and brick buildings that had originally housed the operations of the and turret tops came into vogue. Later the plant was operated for a time automobile bodies for this was back in the days before all-steel construction and turret* tops came into vogue. Later the plant was operated for a time by another wood-working industry and more recently served merely as warehouses for produce and tobacco auctions. It is conveniently located within the city limits of Knoxville and is bordered on two sides by the main lines of the Southern and L&N Railroads. It is supplied with water, sewerage and electric power facilities by the local utilities and has been able to draw on the Knoxville area for practically all of its labor supply, which will shortly exceed 1500 men and women.

That the Defense Plant Corporation was most fortunate both in the purchase and in the use made of these facilities is evident from Tables I, II, and III which show, respectively, the buildings and facilities adapted without major change, the materials and equipment salvaged from the old plant and reconditioned and, finally, the relatively small amount of second-hand equipment and other materials that had to be purchased from other sources. The accompanying illustrations show the extent of the transformation that was effected between October 1942 and March 1943 when the first Plexiglas was turned out by the new facilities.

Some of the original buildings had to be remodelled, principally to put in new foundations to support the heavier process equipment. However, prac-



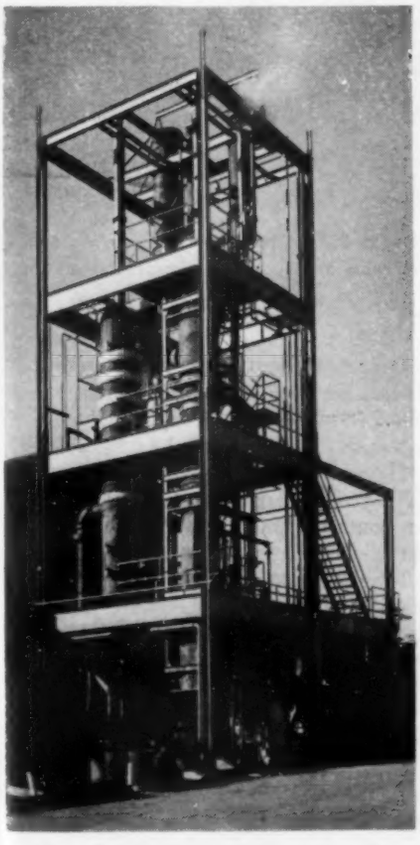
Like a big transparent bubble, the Plexiglas nose of the Martin B-26 Marauder bomber offers complete visibility as well as protection for the forward gunner

* Fate would indeed be playing a queer trick if some day this plant should turn out transparent plastic turret tops for postwar automobiles!—Ed.

Table II.—Materials and Equipment Salvaged from Old Plant and Re-Used

1—500 hp. Babcock & Wilcox boiler—less tubes
1—50 ft. high x 25 ft. diam. wood silo—converted for use with coal
1—Boiler blow-down tank
10—York Heat Diffusing Units, one repositioned for room heating
2—Type SL, Size No. 10 Buffalo blowers from lumber dry kilns used for air filtering system
1—Type E, Size No. 120 American blower adapted to spray tower use
2—15 hp. Sturtevant steam turbines from dry kiln fans used to drive boiler forced draft fans
32—Aerofin heating units from dry kilns all re-used for polymerization oven heating
6—Aerofin heating units from dry kilns adapted to air filtering system
3—Oil circuit breakers
30,000 old brick
20,000 sq.ft. of corrugated Transite from dry kilns re-used for boiler house roof, partitions, etc.
10,000 cu.ft. of rock wool insulation from dry kilns re-used to insulate ovens
36—steel window sash
60—tons of structural steel
3,800 ft. of steel pipe, sizes up to 10 in.
50—valves in sizes up to 8 in.
70—large size pipe fittings
18,200 ft. conduit
19,000 ft. electric wire sizes No. 8 to 500,000 cir.mil
10,000 conduit fittings
125 secondary insulator racks
100 strain insulators
733—RLM lighting fixtures
20—safety switches
Misc. lumber, toilet fixtures, etc.

tically all existing steel columns were left in place, after being reinforced and strengthened at their footings. Equipment layouts were made to conform to the existing floor plan and head-room, although in one or two places it was necessary to project tall columns through the roof and enclose them with new construction. Ingenious use was made of all the structural steel, transite and other siding materials for partitions and construction of boiler-house roofs, tunnel driers, etc. The former lumber kilns were rebuilt into the polymerization ovens, using the same Aerofin heating units, Buffalo blowers and Sturtevant steam turbine drives. A steel silo, 50 ft. high and 25 ft. in diameter, formerly used for sawdust, was quickly converted to store a ten-day supply of coal. A large underground tank used for storing wood waste (hogged fuel) was lined with acid-proof brick to provide storage for acid which would otherwise have required new rubber-lined steel construction.



Open-type of construction was used for new facilities for resin manufacture

Because of the heavy demand for process steam, the original power plant, with its 500 hp. Babcock and Wilcox boiler, had to be rebuilt and extended by the addition of a second unit—a 450 hp. Keeler boiler which was dismantled and shipped to Knoxville from the Rohm & Haas plant at Bristol, Pa. Two automatic 5-retort underfeed stokers were purchased as used equipment and installed to take the place of the original hogged fuel burner.

Reconstruction underway earlier this year as second-hand tanks, salvaged from the Atlantic Coast to the Mississippi, are assembled for storage of materials in process

Table I.—Buildings and Facilities Adapted Without Major Change

Total property area	18 acres
Property area inside of fence	11 acres
Number of buildings	20
Total floor area of buildings	200,000 sq.ft.
Total cubic content of buildings	4,900,000 cu.ft.
Concrete road	300 lineal ft.
Wire fence	2,000 lineal ft.
Railroad siding	1,000 lineal ft.
Underground water mains	1,500 lineal ft.
Underground sprinkler system water mains	3,200 lineal ft.
Sanitary sewer	2,000 lineal ft.
Storm sewer	4,200 lineal ft.
Sprinkler systems inside buildings	15
Deep-well pump	100 g.p.m.
Section of process waste water sewer to river formerly used by city	4,700 ft.
Smokestack	175 ft. high—9 ft. diam.

Refrigeration equipment was picked up from some abandoned Pennsylvania breweries which also contributed many wood and steel tanks—totalling more than 350,000 gal. of storage capacity. One exceedingly interesting "find" was the purchase from an up-state New York dairy of seven stainless steel milk tanks that had long done service on motor truck trailers. Heavily lagged and covered with aluminum sheet, these tanks provide almost ideal storage for some 14,000 gal. of certain refrigerated

Table III.—Used Equipment and Materials Purchased From Other Sources

4—tank cars
7—stainless steel milk tanks, totaling 14,000 gal. capacity used for monomer storage
29—steel storage tanks—total capacity 351,000 gallons
40,000 ft. 1¼ in. seamless steel tubing cleaned and re-used for making condensers
4,500 ft. 2 in. tubing used for handrails
10—machine tools for maintenance shop
1—450 hp. Keeler Boiler
1—5 retort Westinghouse underfeed stoker
1—5 retort American Engineering underfeed stoker
2—forced draft fans
2—boiler feed pumps
1—coal weigh larry
1—ash elevator
1—bulldozer
1—station wagon truck
8—electric motors
4—15 kv. oil circuit breakers
Misc. office furniture and business machines

Some of the piping and valves dismantled and ready for reconditioning for reuse in rebuilding the plant

materials in process of manufacture. Some day, however, some future visitor is going to wonder just why these dumpy, elliptical tanks were designed in such peculiar proportions.

Not all the plant, by any means, could be built of salvaged materials and used equipment. For example, the monomer manufacturing unit required continuous process facilities comparable to those used in a modern petroleum refinery. Borrowing from current practice in that progressive industry, the Rohm & Haas engineers adopted the open-type of construction in which only the control rooms are enclosed so that the operators may be protected from the weather. Everything else is "out of doors," so to speak. Although somewhat new to chemical industry, this type of construction seems certain of much wider adoption after the war. As in most continuous operations, a great deal of emphasis is rightly placed on modern control equipment. In that connection extensive use was made of the new plastic, Saran, instead of copper in tubing for various control instruments. The plant manager reported that he had already developed a preference for such new plastics and saw no reason now for ever going back to metal in some of these applications.

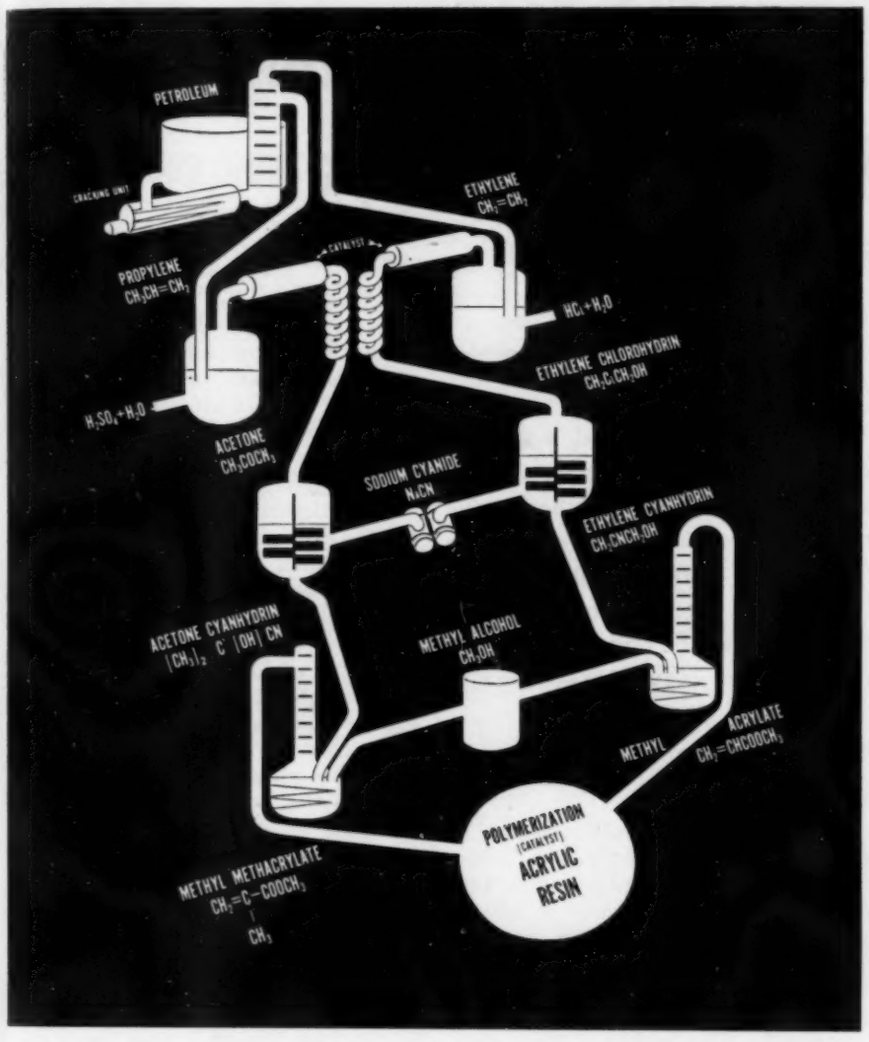
The chief raw materials for the manufacture of Plexiglas are sodium cyanide, sulphuric acid, methanol and acetone. (See flowsheet for the steps involved in this synthesis.)

View in the old boiler plant where welders are rebuilding power equipment to adapt it to process steam production

Existing structural steel had to be reinforced and footings strengthened to support heavier equipment laid out to conform to existing conditions

The sodium cyanide is shipped to the plant from Niagara Falls in special 2-ton containers, loaded 12 to a flatcar. The chemical reactions involved are as follows: acetone is reacted with hydrocyanic acid to yield acetone cyanohydrin. This is hydrolyzed and dehydrated to yield the methyl ester of methacrylic acid.

The crystal clear water-thin monomer of methyl methacrylate must be handled with extreme care to avoid contamination and to prevent premature polymerization. For this reason only stainless steel equipment is used and it must be stored in refrigerated



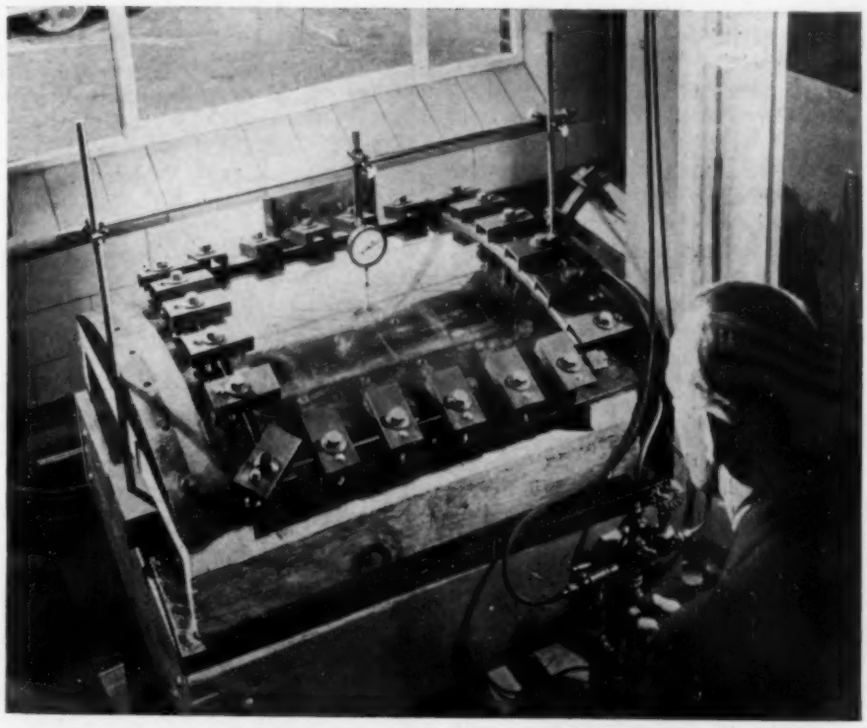
Schematic flowsheet of chemical steps in preparing acrylic resins such as Plexiglas

at temperatures as low as—67 deg. F. Temperature changes of a degree for every 300 ft. of a six-mile climb are not uncommon. The same fragile looking plastic nose on a bomber must be able to withstand rain and snow, sleet and hail, blinding sandstorms and 200-mile winds—always remaining strong, clear and transparent. To meet such exacting needs, the Rohm & Haas Company has provided in its Bristol plant a new physical testing laboratory to duplicate the weathering and pounding that the bomber noses and blisters must take. It even boasts of a machine gun range to conduct bullet impact tests and to study resistance to jar and shock of equipment under actual firing conditions.

That such important and useful war materials can be produced in plants such as this one in Tennessee is indeed a tribute to the resourcefulness and persistence of the Rohm & Haas Company organization. Only the fullest cooperation on the part of its engineering, purchasing, and administrative personnel could have made possible the completion of the project in such record time. It required not only a broad appreciation of the magnitude of the project, but also painstaking attention to detail. A substantial part of the credit for the undertaking goes to Vincent C. Henrich, formerly superintendent of Rohm & Haas Company's Bristol plant, and now superintendent of the Tennessee plant, to whom we are indebted for his cooperation in the preparation of this article.

tanks. The casting of Plexiglas into sheets is accomplished by pouring the monomer between glass plates held together—or rather apart—by special seals at the edges. After the space between the plates is carefully filled and all air bubbles removed, the plates are piled up sandwich style and placed on racks which are drawn by hand trucks into the polymerization ovens. Here they are gently heated for several days and after being further tempered or annealed, the glass plates are removed to yield the clear Plexiglas sheets, which are usually about 36x48 in. in area and $\frac{1}{4}$ to $\frac{3}{8}$ in. in thickness. In this part of the operation extreme care must be taken to see that everything is immaculately clean. All air is filtered and fully conditioned for temperature and humidity. All operators wear special uniforms and every precaution is taken against stirring up dust or dirt from any source.

Plexiglas for use in bombers and other military aircraft must be a precision product, manufactured to meet rigid specifications. The layman seldom appreciates the fact that is stratosphere flights a plane may operate



Air under high pressure is used to determine the deflection of curved panels of Plexiglas in this testing apparatus in R. & H.'s new physical laboratories

Butyl Rubber Production Unique American Development

JAMES A. LEE *Managing Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

This is the first commercial unit in the world designed and constructed for production of butyl rubber (GR-I), an exclusively American achievement. It was developed in the Standard Oil laboratories in 1937. Construction of the first unit for its production was started in 1941 and completed in January of this year. Here is a process that is of unusual chemical engineering interest as the temperature of the reacting materials must be controlled at -150 deg. F., one of the lowest temperatures ever encountered in the process industries. —*Editors.*

AT THE BATON ROUGE REFINERY of the Standard Oil Co. of Louisiana, subsidiary of the Standard Oil Co. (N. J.), is concentrated a greater variety of equipment and processes to make products from petroleum than can be found anywhere else in this country.

Baton Rouge has been called the "cradle of the synthetic rubber industry" in the United States. It was here that Standard Oil Co. of New Jersey conducted its pioneer rubber experiments back in 1931 to develop synthetic rubber raw materials from petroleum. Here is the nation's first fluid catalytic cracking plant, which increases the supply of synthetic rubber raw materials. The company has five separate butadiene plants in operation at Baton Rouge. The Copolymer Corp. is operating a DPC standard Buna S rubber plant here. There is also a plant for the production of Buna N, or Perbunan rubber, and another making Vistanex, a rubber-like material. One of Standard of New Jersey's butyl rubber plants is at Baton Rouge, and work on two other butyl plants there is being rushed as fast as government materials allocations permit.

Construction of the first unit for the production of butyl rubber was started by Standard at Baton Rouge as a private venture in 1941 and was taken over by the government early in 1942. This original plant, which was the first commercial plant in the world for the production of this new product, was completed in January of 1943, and is now producing satisfactory quality production although still at somewhat less than design capacity, due to the enormous number of new manufacturing variables involved and the lack of any past experience with this type of commercial operation. The two additional units authorized by the government are expected to commence production in July and August of this year. The three units were designed for a production of 20 tons of butyl rubber per day. However, the No. 2 unit will be expanded to produce 72 tons per day. The three completed plants will have a design capacity of 38,000 long tons per year. Stone and Webster is building the Baton Rouge plants according to designs of the Standard Oil Development Co. Two other plants for making butyl rubber are under construction, one by the Humble Oil & Refining Co. at Houston, and the other in Canada by Imperial Oil, Ltd.

Butyl is the synthetic rubber developed as a laboratory product by Standard in 1937 and improved by continuous research since that time so that it now plays an important part in the government rubber program. Butyl has not yet matched the tire-making characteristics of Buna S. It can, however, be used to make inner tubes superior to those made from Buna S or natural rubber. Some of its important properties are resistance to oxidation and the action of acids, and high impermeability to gases. Its vibration absorption qualities are good. It has marked resistance to flexure at both low and high temperatures. Butyl has already been used to manufacture such a diversified list of products as tobacco pouches, floor mats, rubber tubing, rubber insulation and many military articles.

The butyl rubber unit that is now in operation at Baton Rouge combines isobutylene, produced at the refinery, with a small amount of isoprene to form the synthetic rubber. Feed stocks start at the oil cracking unit where a gas oil is taken from crude and subjected to high-temperature cracking in the presence of steam. In this cracking operation are produced numerous gases such as ethylene, propylene, butenes, and gasoline fractions. The butene fraction is sent to the extraction plant for removal of butadiene, leaving a mixture of butenes and isobutenes. The mixture of butenes and isobutenes is sent to another plant where isobutene is extracted for subsequent use in the butyl rubber manufacture. The remaining butene is sent to the dehydrogenation plant where it is converted into additional butadiene. At the butyl plant the isobutylene extraction is subjected to a redistillation to remove traces of moisture and any undesirable fractions. It is then ready for utilization in the polymerization reaction.

RAW MATERIALS

Isoprene is now received at the plant in tank cars. It is bought outside from the naval stores industry which makes it from turpentine, but ultimately it will be recovered from gasoline fractions produced in the refinery in a plant now under construction. The isoprene contains an inhibitor which is removed by distillation immediately prior to its use in the plant. The isobutylene and isoprene are mixed together with a diluent in tanks from which it is fed continually to the reactor proper. Before this material is introduced into the reactor it is chilled to a temperature of —150 deg. F., using both ammonia and ethylene for refrigeration. The catalyst is introduced continually into the bottom of the reactor together with the feed stock to start polymerization.

The reactor is so constructed that its temperature may be maintained at —150 deg. F. and sufficient agita-

tion is provided to maintain a thin slurry. The amount of catalyst introduced is controlled to give the desired conversion of isobutylene to butyl rubber.

The products of this reaction, which include butyl rubber polymer, unreacted isobutylene and the diluent, flow into a flash drum maintained at +150 deg. F. This temperature is sufficient to vaporize the unreacted isobutylene, the diluent, and also to destroy any catalyst that may remain. The polymer forms a water slurry in the bottom of the flash drum and after passing through a stripper, operated under vacuum to remove the last traces of the diluent, passes to the finishing building. Here a large portion of the water is removed by a vibrating screen, and the remainder is removed by one pass in a tunnel dryer at 150 to 220 deg. F. Material leaving the dryer is either extruded or milled. Rubber passes through a long series of conveyors where it is cooled by a current of air passing over the rubber ribbon. This ribbon is then cut into sheets and boxed for shipment.

The unreacted isobutylene and diluent leaving the reactor are vaporized in a flash drum, compressed to 30 lb. pressure, dried by passing through alumina dryers, further compressed to 200 lb. pressure, and delivered to a series of fractionating towers for separation of the individual constituents. Some of the constituents are recycled back to the reactor feed drums and others are discarded from the system to prevent accumulations of poisons in the polymerization section.

The catalyst makeup system consists of a series of drums in which solid catalyst bought from outside is dissolved in a portion of the diluent which has been subjected to special fractionation and acid treatment for removal of any material which would affect activity of the catalyst. The catalyst itself before injection into the reactor is maintained at −100 deg. F.

The quality of the product is controlled by a number of variables such as the percentage of isobutylene in the reactor liquor, the percentage of isoprene introduced into the system and amount of conversion that takes place within the reactor.

REACTOR

The reactor is a vessel 4 ft. in diameter by 15 ft. tall with provision made for vigorous agitation and so designed that the temperature may be maintained at −150 deg. F. It has a specially designed head which may be easily and quickly removed in case the reactor becomes plugged due to formation of heavy polymer slurry. Instruments have been provided which, in case of temporary stoppage of flow through the reactor, will automatically bypass the feed around the reactor to the flash drum, and at the same time automatically shut-off the catalyst entering the reactor. When the condensation causing the stoppage of flow through the reactor is corrected, the operation of the valves can be reversed by the automatic instruments and the operation can proceed.

Both the flash drum and the vacuum stripper used for the purpose of flashing off unreacted material are provided with agitators to maintain a uniform slurry of polymer and water.

CATALYST

The catalyst is prepared by dissolving solid material in highly purified diluent previously mentioned. The chilled solution from the catalyst storage is pumped to reactors by a centrifugal pump which maintains a discharge pressure of 120 lb. per sq. in. The catalyst is injected into the reactor through jets which extend into the bottom of the reactor and disperse the catalyst widely through the agitated feed stock in the vessel. Any catalyst not used in the reactor passes out into the flash drum and is destroyed by water in this vessel.

The amount of catalyst introduced into the reactor is governed by the conversion of isobutylene desired as shown by special instruments working on the thermal conductivity principle and showing percentage of isobutylene in the feed mixture entering the reactor and in the gases leaving the flash drum. The difference in isobutylene content of these two streams indicates continually the amount of rubber being made in the reactor at any given moment. This control is essential for successful operation of the plant since there is a hold-up from the time the slurry leaves the reactor until it arrives at the finishing building.

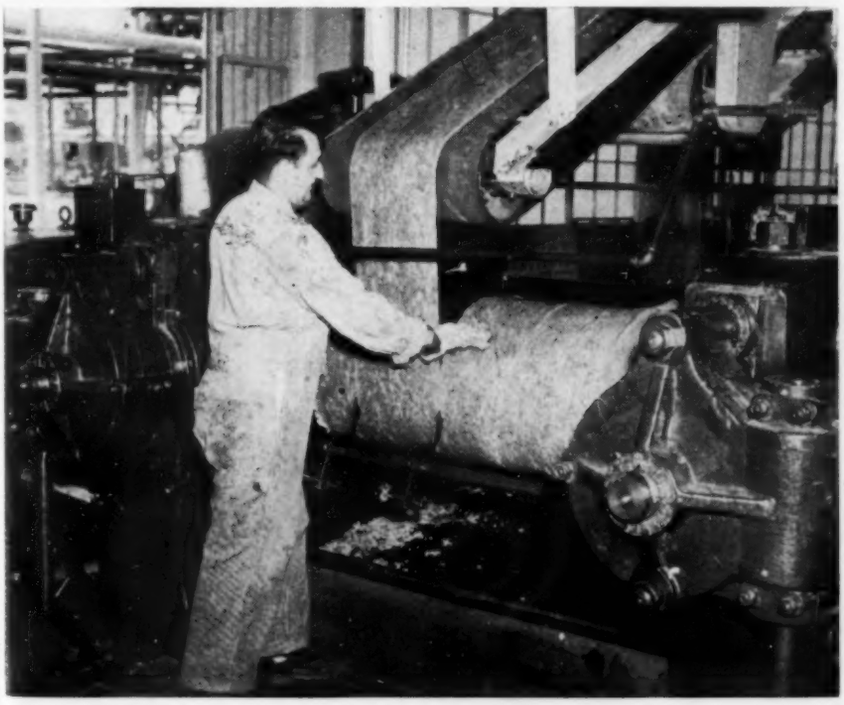
Since the reaction takes place at a temperature far below the freezing point of water all moisture must be eliminated from the various materials making up the feed blend to the reactor. As previously mentioned, the moisture contained in recycled gases is removed by passing the gas through beds of alumina. Two sets of alumina dryers have been provided and while one set is being used to remove moisture from the recycled gas the other set of dryers is regenerated by heating and recirculating natural gas through it.

All distillation is carried out with the use of steam coils.

Rubber is tested as it comes from the vibrating screen at frequent intervals and changes are made in the operations to maintain a product of the desired qualities.

For additional information about the manufacture of Standard Oil Co. (N. J.) butyl rubber the reader is referred to the *Chem. & Met.* pictured flowsheet appearing on pages 132-135 of this issue.

Butyl rubber can be used to make inner tubes for automobile tires superior to those made from either Buna S or natural rubber



Butadiene From Petroleum

EDITORIAL STAFF SUMMARY

Chem. & Met. INTERPRETATION

In the June issue of *Chem. & Met.* production of butadiene from alcohol was described in an article on the government's GR-S (Buna S) plant in West Virginia. This time the editors report on the production of butadiene from petroleum by catalytic dehydrogenation of butene and other methods at the Baton Rouge refinery of Standard Oil Co. of Louisiana. In the latest program announced by Rubber Director William R. Jeffers, 85 percent of all synthetic rubber will be made from butadiene of which 66 percent will come from petroleum and natural gas.—*Editors.*

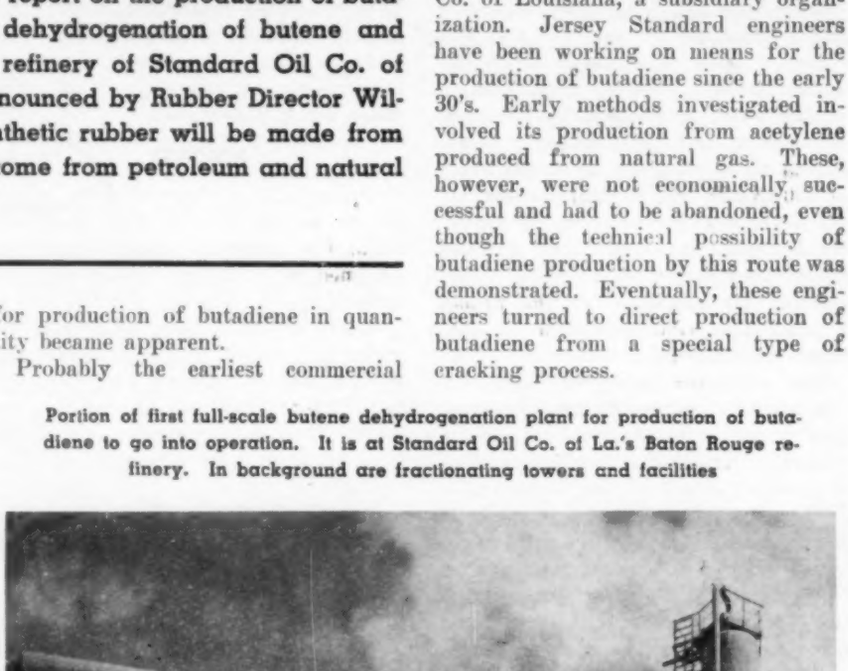
RECENT PRESS ANNOUNCEMENTS of the opening of plants producing rubber from oil herald an achievement in chemical engineering of which all Americans can be proud. In the production of rubber from petroleum one of the most important steps is the preparation in enormous quantities of highly purified raw materials. Principal among these raw materials is the once rare gas, butadiene. It must be no small shock to organic chemists to find this once rarely-referred-to four carbon atom diolefin appearing in the daily press and popular magazines and spoken of with freedom and familiarity by many ordinary citizens.

The transition of butadiene from an objectionable constituent of certain cracked gasolines into a commonplace and valuable bulk raw material has involved development of a number of processes and plant designs whose present success may very well be one of the most important achievements in America's war effort.

Traces of diolefins have long been recognized in gases from cracking oils and even in gasolines themselves. In years past they constituted a problem, since their tendency to polymerize, which is now so dramatically utilized in the production of synthetic rubber, once resulted only in objectionable gummy materials which required removal or destruction before use could be made of either gases or liquid fuels. In many respects it may have been fortunate, however, that these materials were so objectionable, since in this way their presence was known and it was natural for petroleum engineers to turn to this source when the need for production of butadiene in quantity became apparent.

Probably the earliest commercial plants for production of butadiene from petroleum were developed by chemical engineers of Standard Oil Co. of New Jersey as an outgrowth of work originally conducted at the Baton Rouge Refinery of the Standard Oil Co. of Louisiana, a subsidiary organization. Jersey Standard engineers have been working on means for the production of butadiene since the early 30's. Early methods investigated involved its production from acetylene produced from natural gas. These, however, were not economically successful and had to be abandoned, even though the technical possibility of butadiene production by this route was demonstrated. Eventually, these engineers turned to direct production of butadiene from a special type of cracking process.

Portion of first full-scale butene dehydrogenation plant for production of butadiene to go into operation. It is at Standard Oil Co. of La.'s Baton Rouge refinery. In background are fractionating towers and facilities

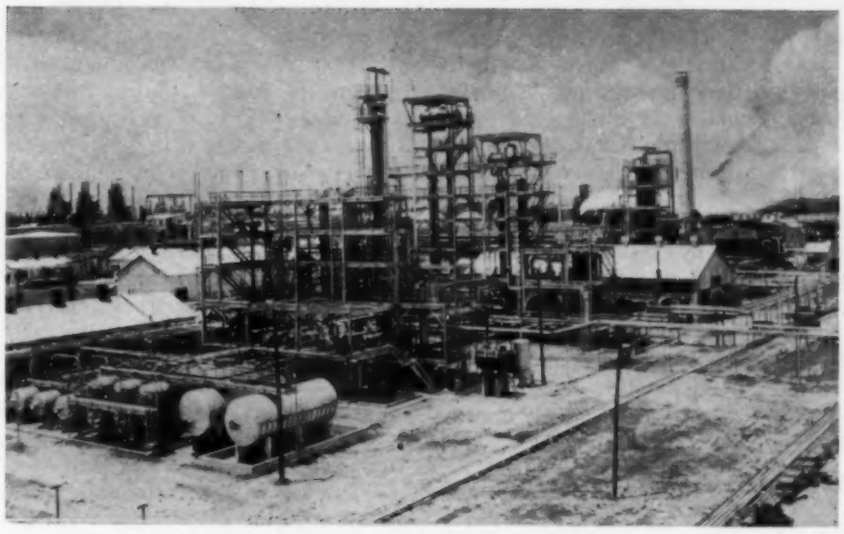


During the middle of the 1930's development work was in progress at Baton Rouge which led to the construction of a cracking plant designed primarily to produce low molecular weight olefins such as ethylene and propylene. These olefins were desired both in the manufacture of tetraethyl lead, for which a large plant has since been constructed by Ethyl Gasoline at Baton Rouge, and for the synthesis of ethyl and isopropyl alcohols, for which large plants also have since been constructed by Standard Oil Co. of Louisiana. To gain high yields of light olefins, light petroleum fractions were cracked at high temperatures and in the presence of large quantities of steam. This method for production of olefins was found highly satisfactory and is now in use in two large-scale plants at the Baton Rouge Refinery.

Concurrently with olefin production, however, substantial quantities of diolefins were produced and these early were developed as a source of butadiene.

Even under favorable conditions, however, the percentage of butadiene obtained was small, substantially less than 5 percent. The recovery of butadiene in these small concentrations and its purification to the degree necessary for rubber manufacture became an early and separate problem for the chemist and engineer.

Direct separation of butadiene by fractional distillation proved impractical, and Standard's engineers then turned to means for concentration by solvent extraction with subsequent purification. As a result of work developed along these lines, a process design was finally developed utilizing a special solution for preferentially absorbing butadiene from the unsaturated gas stream. The absorbing solution was then regenerated, evolving a gas rich in butadiene which could then be purified by appropriate fractionation facilities.



Extraction section of main refinery conversion butadiene installation at Baton Rouge. In middle distance are absorption and fractionation towers for separation and purification of butadiene produced

CONCENTRATION BY SOLVENT EXTRACTION

Since many of the details of the actual purification process now in use still are covered by government patent secrecy orders, it is not possible to give a complete description of the process used at the present time. However, it can be stated that concentration by means of the absorbent solution has proven entirely satisfactory. Certain early difficulties in handling the solution have been overcome entirely. Moreover, satisfactory answers have been found to early problems such as accumulation of undesirable olefins and the possible building up of explosive acetylides in the system due to absorption of traces of acetylene produced in the cracking step.

The prototype steam cracking plant, known to Standard technicians as "OLA No. 1," was soon expanded to include OLA No. 2, and from these plants has come much of the basic design for the industry's "refinery conversion" or "quick butadiene" programs by which very large quantities of butadiene are being made available from the petroleum industry within a minimum length of time. Basically, the refinery conversion units involve remodeling of existing equipment, so as to permit cracking of oil vapors at relatively high temperatures in the presence of steam. Naturally, the equipment available at any refinery location determines the type of and extent of the refinery conversion program necessary. With respect to existing cracking equipment, the conversion usually involves some redesign of the furnaces and the installation of alloy tubing capable of withstanding the high temperatures involved. In the earlier "OLA" plants, the feed stock to the cracking furnaces is a light gas oil, but in the conversion designed primarily for butadiene production, the feed stock is often even lighter fractions such as heavy naphthas.

In addition to the cracking units themselves, substantial additional recovery equipment is usually required in the refinery conversion units. In addition, of course, the absorbing plants for concentrating the butadiene fractions are required.

The process design of the units in which the butadiene fraction is absorbed and regenerated for subsequent purification varies substantially, although the basic principle is the same. In the several plants for butadiene extraction at Baton Rouge, for example, butadiene is extracted in both the liquid and vapor phase. Vapor phase extraction is of course accomplished by countercurrent contacting with the absorbing liquid in a conventional type tower. For liquid phase extraction, conventional towers are used, as well as contacting in a series of small horizontal drums vertically disposed so as to permit gravity interchange of the contacting liquids. No one of the systems used can as yet be considered superior, but as further experience is gained, undoubtedly the most satisfactory and economical system will evolve.

DEHYDROGENATION OF BUTYLENE TO PRODUCE BUTADIENE

Although the first commercial production of butadiene was produced directly by high-temperature, low-pressure cracking, and a substantial part of the petroleum industry's production of butadiene will be derived in that manner, the bulk of butadiene in the present synthetic rubber program will be produced by quite a different procedure. This alternative method involves dehydrogenation of refinery normal butylene, and was developed by Jersey Standard engineers after it became apparent that some more direct method of producing butadiene would be necessary in order to meet the enormous demands brought about by the necessity of meeting the country's rubber needs entirely from synthetic sources. Refinery butylenes are available in large quantities in many refineries and can be produced in large quantities from new type catalytic cracking equipment being installed under present refinery programs.

Chemically, the conversion of normal butylene to butadiene involves simply removal of two hydrogen atoms. Actually the process design involves a number of challenging problems. As now carried out, the process involves passing butylene over a catalyst at high temperatures and at very low pressures. The low pressure could be obtained by the use of vacuum equipment and at one time this was contemplated. However, the design complications of vacuum equipment, involving many problems in addition to that of eliminating air leakage, spurred the search for an alternative method.

CATALYST PERMITS USE OF STEAM AS A DILUENT

Obviously, one method of eliminating the necessity for operating under a vacuum would be to reduce partial pressure by the use of steam. Unfortunately the catalysts first developed were poisoned by steam and for some time it was thought that this method of processing would be impossible. However, research again was called upon to solve a serious problem quickly, and again the research groups turned up in time with a catalyst which would permit design of the equipment to use steam as a diluent for the reacting gases.

The butene dehydrogenation plant now in operation at Baton Rouge is the first to carry out this process on a large scale, and to date the operation, in terms of plant officials there, is "highly satisfactory." While the plant has not as yet been in operation for more than a few weeks, it has already exceeded substantially and continuously its design capacity. In carrying out butene dehydrogenation, the refinery gas stream, rich in normal butylene, is first purified so as to increase to a maximum the concentration of normal butylenes in the feed stock. These gases are then diluted with steam and subject to high temperatures in contact with the dehydrogenation catalyst. The reaction vessels in which this contact is accomplished are of a highly intricate design and their details cannot now be disclosed for reasons of national security. As the reaction progresses, the catalyst gradually loses activity and it is necessary periodically to regenerate the catalyst by treatment with steam, also at elevated temperature.

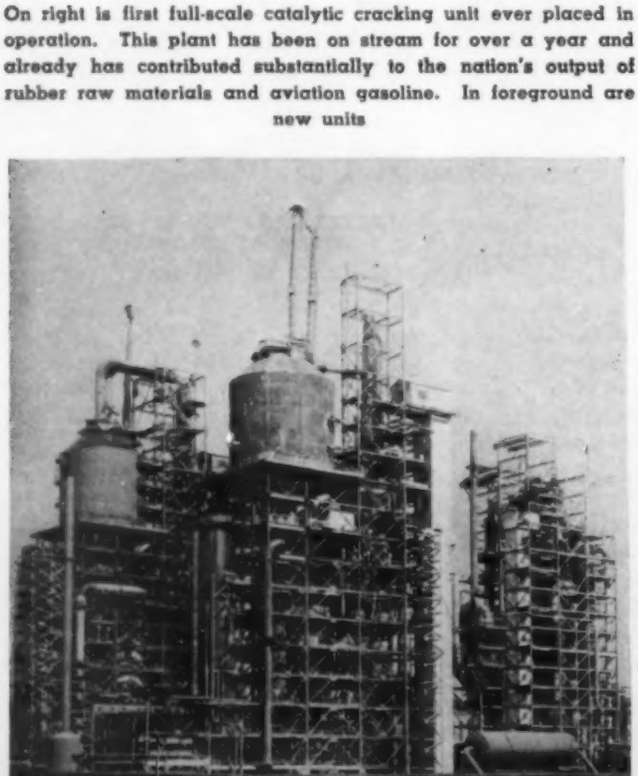
Substantial conversion of butene to butadiene is accomplished and the reacted gases are then fractionated, separating normal butylenes for recycling, and providing a butadiene-rich stream to the final purification system.

The concentration and purification equipment used in connection with butene dehydrogenation corresponds in most of its principles and construction to the equipment used in purifying butadiene from the direct cracking or refinery conversion plants. The purity of butadiene is of particular importance and recent developments have made it possible to reach an extraordinarily high quality of product in this respect.

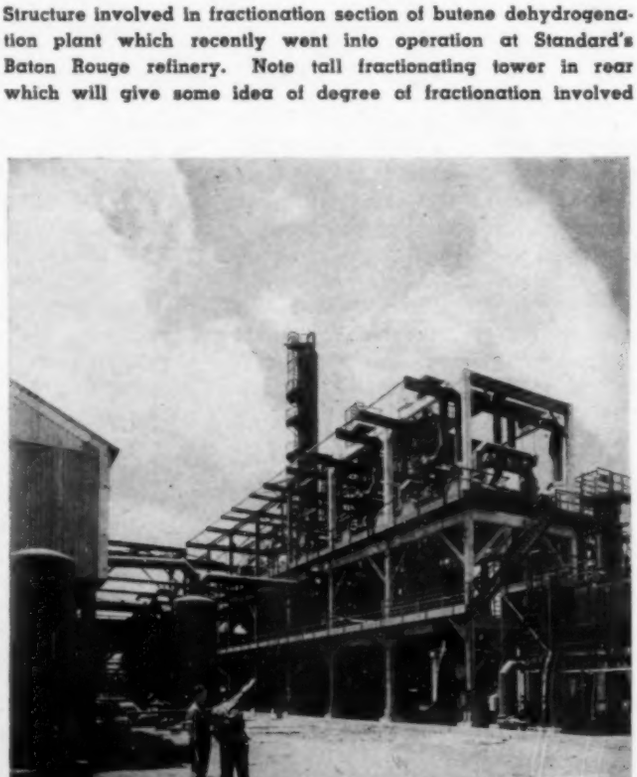
MUCH BUTADIENE WILL BE DERIVED FROM PETROLEUM

In the latest program announced by Rubber Director Wm. R. Jeffers, the bulk of all butadiene to be produced from petroleum, totaling about two-thirds of the butadiene to be derived from oil, will be made by catalytic dehydrogenation of butene by the method substantially as described above. There will be a small amount of butadiene production directly from natural gas butane involving first a dehydrogenation of butane to normal butylene and a secondary dehydrogenation, in a manner similar to that described above, to butadiene.

On right is first full-scale catalytic cracking unit ever placed in operation. This plant has been on stream for over a year and already has contributed substantially to the nation's output of rubber raw materials and aviation gasoline. In foreground are new units



Structure involved in fractionation section of butene dehydrogenation plant which recently went into operation at Standard's Baton Rouge refinery. Note tall fractionating tower in rear which will give some idea of degree of fractionation involved



New Data on Activated Bauxite Desiccants

R. G. CAPELL, R. C. AMERO and J. W. MOORE *The Floridin Co., Warren, Pa.*

Chem. & Met. INTERPRETATION

Adaptable to all processes involving the use of granular drying agents, a new activated bauxite desiccant offers a number of advantages over the older types. Among the advantages claimed are performance equal or superior to other granular desiccants in drying efficiency and general performance, and greater economy in use because of lower initial cost and longer life under certain service conditions. Laboratory and field developments are described here with emphasis being placed on large scale dehydration of organic liquids and gases at greater than atmospheric pressure.—*Editor.*

A NEW granular drying agent of the same general type as silica gel, activated alumina and Drierite, has achieved wide-spread acceptance[1-8] because it has longer life under many conditions of use and costs less initially. Florite, as the desiccant is called, has another advantage during the present raw materials crisis in that it is manufactured from less critical materials than most other desiccants of the same type. Present uses range from a fraction of a pound in glass columns for drying air in laboratory experiments to units containing 45 or 50 tons for drying synthetic rubber feed stocks. The extreme dryness obtainable, coupled with simplicity of operation, has made the use of this desiccant advantageous in many applications. Although it is well adapted to all processes where other granular desiccants have been used, development work has been carried out mainly in the large scale dehydration of organic liquids and of gases at greater than atmospheric pressure.

DRYNESS OBTAINABLE

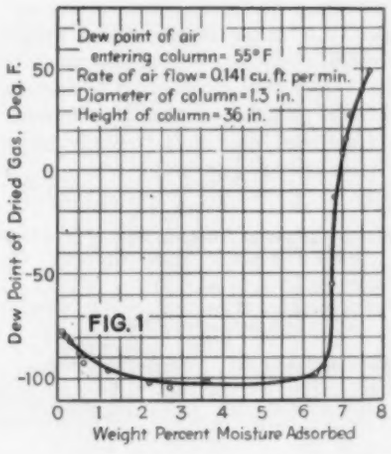
A typical Florite drying cycle has been plotted in Fig. 1, showing the dehydration of a stream of air. Experiments on the dehydration of liquid hydrocarbons give curves of a similar shape. Three characteristic sections of the curve may be distinguished — the "induction period" or period of falling dewpoint; the inverted plateau at the minimum dewpoint; and the sharp rise in dewpoint after the break-point is reached. The induction period generally passes unnoticed in industrial applications because the initial dewpoint is extremely low, even though it is not as low as that ultimately obtained. On the other hand, in the liquefaction of air for oxygen production and in the liquefaction of natural gas for helium, the maximum removal of moisture must be effected at all times. Experimental work has shown that the induction period is not a characteristic of the adsorbent but is due solely to the presence of moisture in the equipment between the desiccant bed and the dewpoint tester at the start of a test run. This is plausible when it is observed that the difference in moisture content between air with a dewpoint of —75 deg. F. and —104 deg. F. is 6.2×10^{-7} lb. per cu. ft., while atmospheric air at 70 deg. F. and 40 percent relative humidity, present in the equipment at the start of the test, contains 4.7×10^{-4} lb. of moisture per cu. ft. If the induction period is disregarded, Fig. 1 shows that Florite adsorbed moisture at maximum efficiency up to a capacity of 6 percent or throughout 80 percent of the total drying cycle. The dewpoint of the dried air during this period was between —100 and —150 deg. F., which means that the equilibrium vapor pressure of the desiccant is less than 1.2×10^{-3} mm. Hg. Previous work by Bower[9] has shown the equilibrium vapor pressure of alumina (the chief constituent of Florite) to be of the order of magnitude of .000004 to .000009 g. per l. of water, or between 3×10^{-3} and 7×10^{-3} mm. Hg. On the basis of this earlier information, the minimum available dewpoint would have been predicted as not less than —89 deg. F.

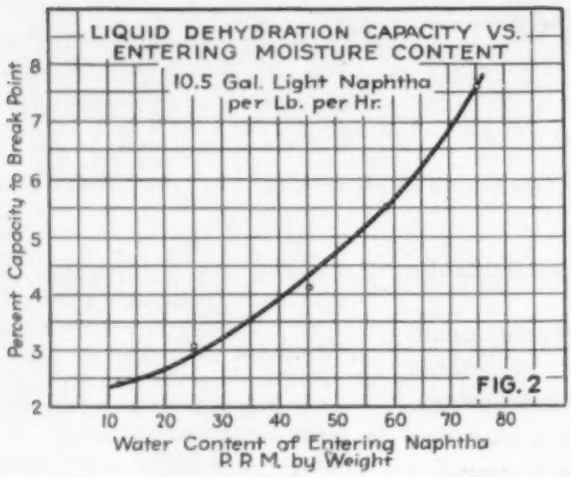
These results are backed by frequent field observations of dewpoints below —75 deg. F. and reports from one gas liquefaction plant of dewpoints below —104 deg. F. (Since only a certain degree of protection is usually required for a process, dewpoints are generally recorded as "less than" a given figure because it is difficult and unnecessary to determine the actual value.)

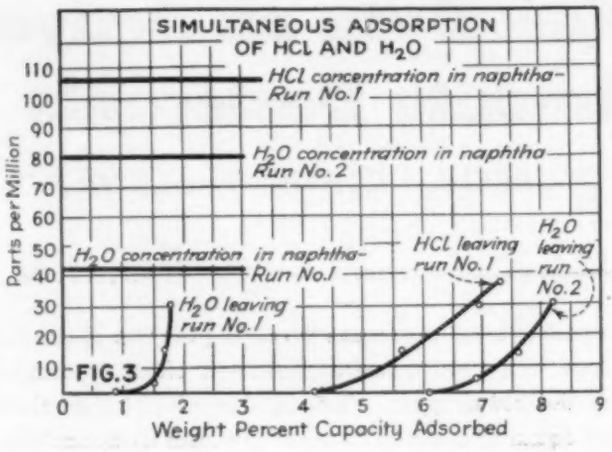
The end of a drying cycle is usually determined by the rise in dewpoint of the gas leaving the tower, but where the maximum protection against moisture is required the gas may be sampled at some intermediate point in the desiccant bed. For example, if the desiccant were supported on a number of separate screens in a tower, dewpoints would be taken on the gas before it passed through the last screen. By sacrificing the capacity of the last portion of the desiccant in this manner, a continuous flow of gas with a dewpoint of —100 deg. F. to —105 deg. F. would be obtained. In one plant drying a liquid petroleum fraction, each half of the drying unit consisted of two towers of equal size connected in series. Moisture determinations were made on the stream leaving one tower to enter the second. Thus, a very liberal margin of safety was assured.

In the drying of liquid hydrocarbons, such as petroleum fractions ranging from propane to No. 2 fuel oil, chlorinated hydrocarbons such as CCl_4 and aromatics such as benzene and toluene, Florite will remove moisture down to 10 p.p.m. or less. The Karl Fischer method of determining moisture [10-12] which is accurate to 4 p.p.m., consistently shows absolutely no

Typical Florite drying cycle


Dew point of air entering column = 55° F
Rate of air flow = 0.141 cu. ft. per min.
Diameter of column = 1.3 in.
Height of column = 36 in.
Dew Point of Dried Gas, Deg. F.
50
0
-50
-100
FIG. 1
0 1 2 3 4 5 6 7 8
Weight Percent Moisture Adsorbed


LIQUID DEHYDRATION CAPACITY VS. ENTERING MOISTURE CONTENT
10.5 Gal. Light Naphtha per Lb. per Hr.
Percent Capacity to Break Point
Water Content of Entering Naphtha P.P.M. by Weight
FIG. 2


SIMULTANEOUS ADSORPTION OF HCl AND H_2O
HCl concentration in naphtha—Run No.1
H_2O concentration in naphtha—Run No.2
H_2O concentration in naphtha—Run No.1
HCl leaving run No.1
H_2O leaving run No.2
H_2O leaving run No.1
Parts per Million
Weight Percent Capacity Adsorbed
FIG.3

moisture present until the break-point is reached. These results are strengthened by field observations that Florite dries propane below the requirements of the N.G.A.A. Cobalt-Bromide Test[13] which is sensitive to 20-30 p.p.m. of moisture.

MOISTURE ADSORPTION CAPACITY

The capacity of Florite is influenced by many factors, such as the depth of desiccant bed (column height), mesh size of the desiccant, time of contact between fluid and desiccant, and the chemical nature and moisture content of the fluid to be dried. The effect of moisture content is shown in Fig. 2, in which the capacity to the break-point in the dehydration of naphtha and the equilibrium capacity in the dehydration of atmospheric air are plotted against the entering moisture content of the respective fluids.

The effect of column height and the effect of mesh on the dehydration of naphtha are shown in Tables I and II. The time of contact between the fluid and the desiccant influences the moisture capacity to some extent, as shown in Table III, although relatively good efficiency is maintained even at short contact times. Time of contact and column height are related but not identical, since Table II shows increased capacity with increased column height although the flow rate of the naphtha was increased in proportion to column height so that the contact time between naphtha and desiccant was the same in each case (31 seconds).

Table I—Effect of Column Height on Moisture Adsorption from Naphtha

(16/30 mesh desiccant, 70 p.p.m. initial moisture content of naphtha, 31 sec. time of contact between desiccant and naphtha.)

Column Height, In.	Capacity to Break-Point, Percent
10	6.3
19	5.1
35	6.7
57	7.2
70	9.7

Laboratory work on liquid dehydration has shown that with contact times as low as 10 sec., dehydration is still effected at maximum efficiency and the literature[14] mentions satisfactory results with three seconds contact time. Two commercial units are drying liquid pipeline products at 36 and 30 sec. contact time, respectively, while a typical gas drying unit is operating at 12 sec. contact time.

In the majority of applications, column height, mesh, and contact time are secondary considerations as far as capacity is concerned, the determining factors being the quantity of desiccant required for an operating cycle of the desired length, the diameter of vessel required to give a satisfactory fluid velocity, and the maximum allowable pressure drop. Unless unusual conditions are to be encountered, a design figure of 5 percent moisture capacity is used.

Up to the present time, attempts to dehydrate alcohols have been unsuccessful because the hydroxyl radical is adsorbed as strongly as the moisture. Strongly acidic gases, such as HCl, are also adsorbed, thus reducing the capacity for moisture. Fig. 3 shows the relative affinity of Florite for HCl and water dissolved in naphtha. In the first test, the naphtha contained both HCl and moisture, in the second only moisture. The curve shows the ratio of moisture adsorption to acid to be practically the same as the ratio of initial moisture and acid content. This would indicate that the affinity of the desiccant for the acid and the water was equally strong and one was not replaced by the other as the adsorption proceeded.

Table II—Effect of Mesh on Capacity

(75–80 p.p.m. initial moisture content of naphtha; 7.3 gal. per sq. ft. per min. flow rate.)

Mesh Classification	Capacity to Break-Point, Percent
16/30	7.6
8/20	7.2
4/8	6.4

PRESSURE DROP

The variation in moisture capacity with mesh, as shown in Table II, would suggest the use of smaller sizes for greater capacity but in practice there has been no trend in this direction. This is probably due to the increased pressure drop through the smaller sizes, although in liquid drying units, pressure is quite small in any event.

Referring to Fig. 4, it will be seen, for example, that a plant passing 22 gal. per sq. ft. per min. through a 10-ft. bed of 8/16 mesh Florite will have a pressure drop of only 6.9 lb. per sq. in. The pressure drop through gas drying units is more critical because higher velocities and greater bed depths are used. For example, a pressure drop of 15 lb. per sq. in. was measured across a 20-ft. bed of 4/8 mesh Florite drying 2,000,000 S.C.F. per hour at 920 lb. per sq. in. pressure and 56 deg. F. For this reason, 4/8 mesh has been the most widely used size.

FLUID VELOCITY

The question has often arisen as to what is the maximum velocity at which gas can be passed up through a bed of Florite desiccant without disturbing the bed and causing abrasion of the granules. Up to the present time, no satisfactory correlation of pressure, temperature, mesh size and lifting velocity has been found. An arbitrary limit of 100 ft. per min. has been set on the flow of gas through 4/8 mesh Florite, although the majority of plants do not exceed 60 ft. per min. and in

Table III—Effect of Contact Time on Efficiency and Capacity

(Dehydration of air at atmospheric temperature and pressure.)

Calculated Contact Time, Sec.	Minimum Dewpoint Obtained in Test, Deg. F.	Moisture Capacity to Dewpoint of 32 Deg. F., Percent
3.5	Less than −100	6.3
1.2	Less than −40	4.5
0.62	Less than −58	4.5
0.50	Less than −49	3.4

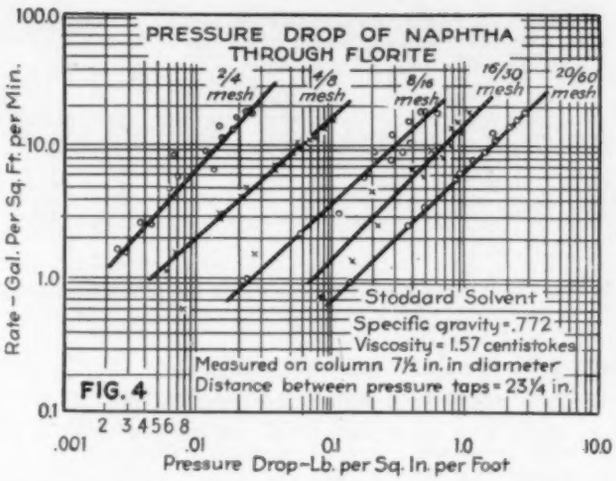


FIG. 4

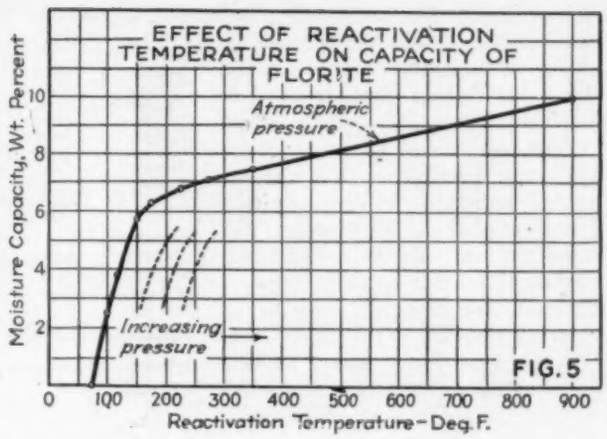


FIG. 5

addition, the main drying cycle is generally carried out with the gas flowing down through the tower, only the smaller flow of regeneration gas going in the other direction.

One plant operating with an upflow velocity of 180 ft. per min. has shown consistently poor capacity and abrasion of the granules, regardless of the type of desiccant used; another plant with a downflow velocity of 125-150 ft. per min. at 1,050 lb. pressure has been troubled with abnormally high pressure drop. For liquid products, velocities range up to 30 gal. per sq. ft. per min., with 10-15 gal. per sq. ft. per min. representing a good average. On regeneration, gas velocities corresponding to good practice on a gas drying unit of similar size are used.

REGENERATION

It has previously been reported that satisfactory regeneration of a moisture saturated desiccant could be carried out by heating at 350 deg. F., regardless of the total pressure of gas surrounding the desiccant.[a] This has been found to be true, even at 1,200 pounds pressure and higher, but in the light of the following observations, the statement can be expanded considerably: (1.) Information presented in Fig. 5 shows that 6 percent of the adsorbed moisture can be removed at 150 deg. F. at atmospheric pressure. (2.) One commercial unit is drying gas at 150 deg. F. and 180 lb. per sq. in. pressure and getting good capacity with regeneration temperatures of 400-450 deg. F. (3.) Reports from a number of field units show that the temperature at which the bulk of the adsorbed moisture is removed is a direct function of the total pressure.

It could be deduced from theoretical considerations that the equilibrium moisture content of a desiccant would be influenced by the vapor pressure and temperature of the fluid with which it is in contact (see Fig. 2), but the above considerations indicate that the total pressure of the system, as well as the vapor pressure, has an effect on the equilibrium moisture content. The broken lines in Fig. 5 indicate the equilibrium trend at higher pressures, but limitations on the regeneration temperature readily available in the field make it impossible to complete the curves at this time.

As a practical consideration, depressuring a unit for regeneration is advantageous because at lower pressure the same degree of regeneration can be accomplished at a lower temperature, or a unit can be more thoroughly regenerated at a given temperature. Depressuring is practiced where a source of low pressure gas is available, or the high pressure gas can be expanded down and used for fuel or sent to a flare after it has been used for regeneration.

However, since low pressure gas carries less heat per flowing cubic foot, the regeneration cycle is lengthened unless higher gas velocities are used. Also, any appreciable degree of depressuring on a large, high pressure unit is time-consuming and calls for caution on the part of the operator to prevent plugging the expansion valve with ice or hydrates. (When the regeneration cycle is started, the desiccant is exhausted, and the gas may contain some moisture.) Repressuring the unit after regeneration is attended by the same disadvantages. In addition, it is too costly to boost the regeneration gas back to full line pressure and generally not possible to consume all of it for low pressure uses.

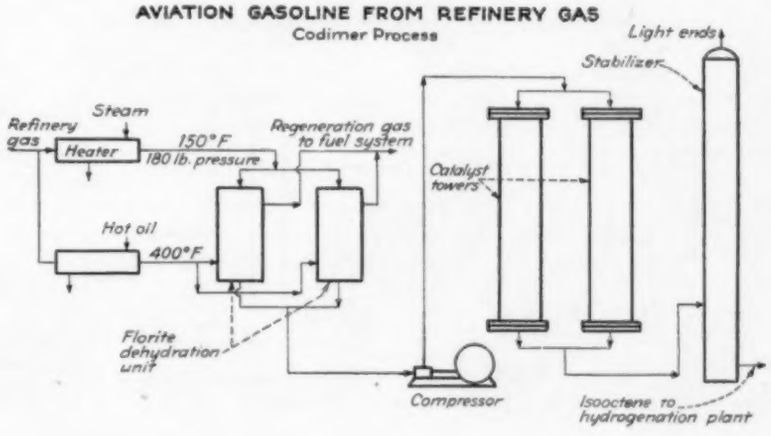
As a general statement, drying units above 600 lb. pressure are not depressured for regeneration; below 600 lb., depressuring to some degree is optional.

ADVANTAGES

The solid adsorption type of dehydration is not only recognized as the most practical method to use where extreme dryness must be obtained, but is also being found applicable under conditions where a liquid adsorption method, such as that using glycol, would appear more economical at a first glance but is ruled out by certain operating conditions. For example, in the codimer process described below, the gas is at a relatively high temperature which would cause considerable loss of glycol by evaporation and the vapors might conceivably cause undesirable reactions in the catalytic chambers.

Although granular desiccants may be considered to have indefinite life under very favorable conditions of use, they must be replaced periodically in most industrial applications. This is

AVIATION GASOLINE FROM REFINERY GAS
Codimer Process



generally due to fouling with oily, tarry, or carbonaceous deposits removed from the fluid or formed by catalysis of certain constituents of the fluid. Hydrogen sulphide also has a deleterious effect, although the effect has never been measured quantitively, and it is not definitely known whether hydrogen sulphide will precipitate elemental sulphur in the complete absence of oxygen. In the dehydration of cracked or sulphur-containing gases, or fuel oil, desiccant life may be as short as six months; on the other hand, one Florite unit drying sweet natural gas containing a trace of compressor oil has maintained a moisture capacity of 6 percent for over a year and a half with no indication that replacement will ever be necessary. Therefore, replacement must be considered as an operating expense in many installations, although some designers prefer to regard the desiccant as a small fraction of the initial cost of a drying unit. The conditions of use will indicate whether the latter approach is justified in any particular case.

Even though severely fouled, Florite desiccant gives good drying efficiency. The point of discard is determined by loss of capacity rather than loss of efficiency. That is, if the drying agent is being fouled with some foreign deposit, the amount of gas that can be dried in each cycle decreases steadily until the point is reached where one tower can not be regenerated before the other is exhausted.

APPLICATIONS

Table IV will serve as an indication of plant designs that have proven satisfactory in service under a wide variety of conditions. One interesting feature in connection with the first unit in this table is the fact that the gas stream contains a relatively high concentration of condensables in the gasoline range, and that in addition to adsorbing 6-7 percent moisture on each drying cycle, Florite is adsorbing commercially important quantities of distillate which are recovered on regeneration.

Table IV—Typical Dehydration Units

Location	Material	Quantity Per Day	Pressure, Lb., per Sq. In.	Height of Towers, Ft.	Dia. of Towers, Ft.	No. of Towers	Lb. Florite in Unit
Louisiana	Natural gas	100 MMCF[1]	1,200	20	3	4[2]	13,600
Texas	Natural gas	80 MMCF	750	18.5	5.5	2	40,000
Oklahoma	Natural gas	60 MMCF	1,800	....	....	..	16,000
Penna.	Natural gas	15 MMCF	250	8	3.5	2	7,200
Illinois	Natural gas	10 MMCF	600	30	3	2	14,000
Penna.	Refinery gas	375 MMCF	180	8.5	3	2	6,600
Illinois	Liquid propane	30,000 gal.	.....	6.5	1.29	2	850
Kansas	Pipeline products up to fuel oil	11,000 bbl.	.....	9	4	4	12,000

[1] MMCF: Million standard cu. ft. [2] Two of the four towers are filled with competitive material for a comparative test.

The alkylation of light petroleum fractions to aviation gasoline by the use of anhydrous hydrogen fluoride catalyst is diagrammed below. A dry feed stock to the catalytic unit is necessary to prevent the loss of catalyst and to prevent the dilution of HF to the point where it will corrode equipment. In this application, a moisture content of 4-5 p.p.m. is the maximum that can be tolerated.

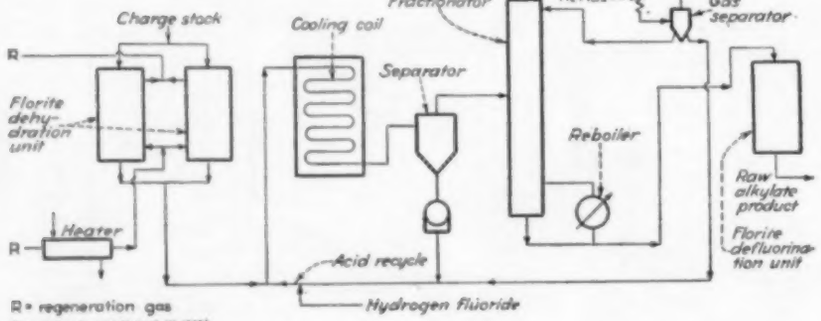
The primary function of the defluorination tower is to remove HF and fluorides from the alkylate but there is some disagreement on this. For example, in an article by Simons[15] it is reported "In none of the condensation reactions has fluorine-containing products been found" while it is stated by another source[16] "The main loss appears to be by the formation of alkyl fluorides, but these can be decomposed by passing the alkyl fluorides over granulated calcium or aluminum fluorides, which decomposes the alkyl fluorides into the corresponding olefins and hydrofluoric acid."

Another new application of significance is the U.O.P. codimer process shown on p. 109, in which the feed stock is dried to prevent damage to the catalyst. The concentration of valuable condensable hydrocarbons in the gas is so large that the temperature must be maintained at 135 deg. F. or higher throughout the drying cycle to prevent condensation and loss. The first of these units to be installed is drying 350,000–375,000 cu. ft. per cycle at 150 deg. F. and 180 lb. pressure in a unit containing 3,300 lb. of Florite per tower. Since an estimated 24 gal. of water is removed from this amount of gas, the adsorption capacity appears to be slightly over 6 percent, which is much higher than was predicted for this type of operation. The actual criterion of performance is the fact that the catalyst has not been damaged by water vapor after two months of service.

Other problems which have been new but more routine in nature have included the drying of liquids to prevent the formation of ice at −25 deg. F., drying gases at more than 1,500 lb. pressure, and completely dehydrating closed volumes to prevent the corrosion of metals. In some cases, the desiccant is used as a catalyst or catalyst carrier, rather than a drying agent.[17]

The authors wish to thank the Universal Oil Products Co. for permission to describe the relation of solid dehydration to the codimer process, and Mr. L. B. Christie for assistance in carrying out test work and preparing drawings.

HYDROFLUORIC ACID ALKYLATION



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New Approach to Continuous Reactor Design—I

A. BROTHMAN, A. P. WEBER and E. Z. BARISH *Engineers, Chemurgy Design Corp., New York*

Chem. & Met. INTERPRETATION

This is the first of three articles dealing with a new theoretical approach to the problem of design of continuous processing equipment for carrying out liquid-phase reactions and other combining and mixing operations. By use of the methods developed by the authors it has been found in practice that a close approximation of the actual performance of the equipment can be predetermined, enabling the designer to calculate the number, capacity and arrangement of the vessels required for a given throughput and degree of completion of the reaction. The mathematical derivation of the expressions used is complex and is presented here only in summary. Use of the derived expressions, however, is not difficult and offers a quicker and more accurate path to continuous reactor design than previously available.

The first article presents the basic derivation of the expression showing how long an average particle of material will remain in a given sequence of continuous processing vessels. The second article couples this expression with the characteristic combining-velocity equations for various sorts of combining phenomena, and also presents useful circulation capacity data on various mixer types. The third gives a detailed practical demonstration of the use of the new methods in the solution of an actual design problem. It should be noted that the present articles apply specifically to liquid-phase combining phenomena. However, the authors have recently found it possible to extend the mathematics also to vapor- and gas-phase reaction systems where bypass effects are employed.—*Editors.*

One of the prime objectives of production men and plant designers has always been to put all plant operations on a rationalized "assembly-line" basis—to put each unit operation in a manufacturing sequence on a basis such that the operation will provide a uniform, steady, and continuous feed for its sequel. Especially today, with the United States on a war footing and production one of the most vital elements in bringing this war to a quick and victorious end, rationalized production is high on the list of "musts." When the chemical and process industries can employ "assembly-line" production they are able to feed raw materials continuously in one end of a plant, maintain continuous flow through all of the unit operations involved and, finally, discharge continuously for disposition at the other end of the plant. Advantages for such operation include:

1. The elimination of all "dead-time" in charging and discharging batch types of equipment and in bringing an accumulated mass of material to appropriate processing levels of temperature and pressure, etc., thereby increasing the productive time of the plant.

2. A reduced requirement for highly trained personnel from the already-strained manpower reservoir.

3. Greater uniformity of products through the elimination of the human element in control.

4. A pronounced decrease in the cost of production.

5. In most cases, a greater productivity per unit volume of tankage per unit of time.

It is the purpose of this series of articles to present a rational method for designing continuous equipment for handling those combining phenomena (reactions, dissolving, blending, emulsifying, etc.) in which a liquid phase enters as the principal scene of the combining phenomenon and which are characterized at times by comparatively low combining velocities. This development, the authors believe, fills in one of the last remaining links in making "assembly-line" production possible for the process and chemical industries. The notable success which has typified the use of continuous calciners, kilns, attrition and grinding mills, vapor phase reactors, stills, filters, centrifuges, dryers, crystallizers, etc., as well as the continuous equipment for handling other chemical engineering unit operations will in our belief spur the utilization of the following material.

In Fig. 1, what the authors consider to be a continuous mixing vessel of high efficiency is illustrated. However, the construction shown should not be regarded as a specific recommendation in any respect, since a large number of other specific arrangements for the indicated "elements" can be usefully employed to satisfy the general operational characteristics of the device shown. In fact, other specific arrangements embodying the principles of operation shown in Fig. 1 may be more advantageously suited to certain particular instances.

Let us proceed to break down the structure shown in Fig. 1 into its elements, and investigate each of the elements with respect to the direct function or functions it serves:

1. The direct functions served by the draft tube are: (*a*) to "channelize" the path of the incoming stream, so that the new feed is subjected to the very intensive mixing action which exists in the immediate neighborhood of the "homogenizing" mixers; and (*b*) to restrict to some approximate *predictable* limit the smallest length of time which a particle can spend in the mixing unit by defining the *average* course which the particle will travel from inlet to outlet nozzle.

2. The direct function served by the recirculation ports in the draft tube is

to permit a recycling of a portion of the material which was previously exhausted from the draft tube, back into the draft tube and down through the "homogenizing" and exhausting mixer elements.

3. The direct functions served by the "homogenizing" mixers are: (*a*) to provide optimum conditions of agitation under which the reacting or combining action proceeds; and (*b*) to provide for the fullest possible blending of the incoming stream with the previously fed materials that are being recirculated through the ports in the draft tube.

4. The direct functions served by the draft tube exhausting mixer are: (*a*) to cause a constant "turnover" of materials in the mixing vessel by continuously exhausting the contents of the draft tube; and (*b*) to aid and augment the effects of the "homogenizing" mixers in certain sizes of mixing assemblies. (In such cases the draft tube exhausting mixer element may perform both the functions of providing the draft tube exhausting action and the "homogenizing" mixers' effects.) It may also be pointed out here that in most instances, propeller or turbine type mixers would be used to discharge the pumping function of the draft tube exhausting mixer. Although paddles (of either the "pitched" or normal blade types) could, if assigned the proper speed, perform the required task, turbines and propellers, if properly designed, and assigned proper operational characteristics, would perform with greater efficiency than paddle type mixers.

5. The direct functions served by the mixing vessel and the inlet and outlet nozzles are, of course, obvious.

A cursory examination of the mode of operation of the equipment shown in Fig. 1 reveals that, for the condition of continuous feed and continuous discharge, there does not exist any means whereby a uniform retention within the equipment for all portions of the feed is assured. In other words the effluent from the equipment would be made up of portions which had stayed for various periods of time in the system. Yet, it is known that the completion of combining phenomena does vary as some function of the time spent in the system. Since such is the case, the problem must be approached

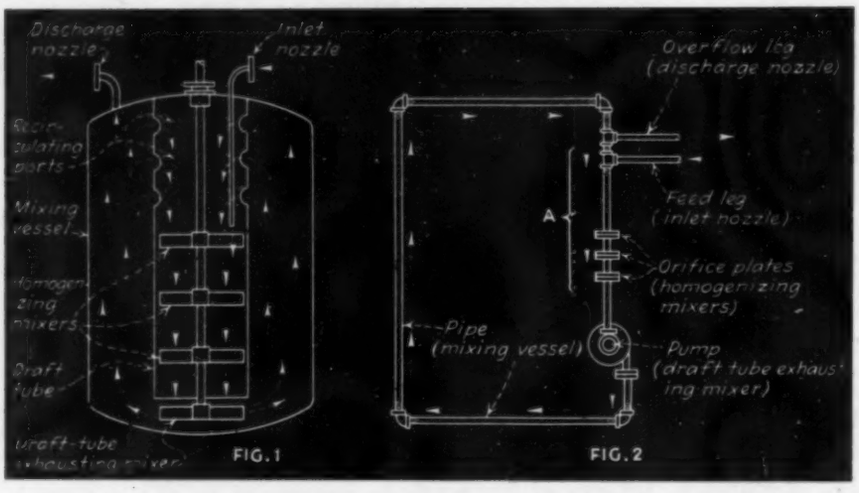


FIG. 1 FIG. 2

Fig. 1—A high efficiency continuous mixing vessel

Fig. 2—An idealized representation of the mixing vessel of Fig. 1

as described below if we are to be able to predict the efficiency of a given continuous mixer.

The problem resolves itself into two main tasks: (*a*) to obtain some quantitative picture of the effluent from the equipment in terms of the retention times in the system of each discrete portion of the effluent; and (*b*) this quantitative picture of the effluent must be combined with the completion velocity characteristics of the particular combining phenomenon involved, in order to obtain the mean completion typifying the effluent. The present article is concerned with task (*a*), the second with task (*b*).

Expressed mathematically, it will be our goal to be able to compute the mean level of completion of a given combining phenomenon in the effluent from a continuous mixer after the manner set forth below:

$$S = P_1 f(t_1) + P_2 f(t_2) + P_3 f(t_3) + \ldots P_n f(t_n) \quad (1)$$

where S = the mean completion of the combining phenomenon; P_1, P_2, P_3, . . . P_n = the proportions of the discharge respectively corresponding to retention times equal to t_1, t_2, t_3, . . . t_n; and $f(t_1)$, $f(t_2)$, $f(t_3)$, . . . $f(t_n)$ = the extents of completion of the combining phenomenon at hand, in terms of functions of t_1, t_2, t_3, . . . t_n. To facilitate the discussion of the entire problem, we shall hereafter refer to the quantitative analysis of the effluent—the P_1, P_2, P_3, . . . P_n of Equation (1)—as the "time-proportion" composition of the effluent.

Before we proceed with the detailed investigation of the problem, it should be noted that various reasons may from time to time compel the use of several identical units in series. These reasons may include such factors as the physical limitations on vessel size imposed by a certain factory building, the heat transfer surface requirements of the combining phenomenon involved, or certain reaction-mechanics peculiarities which are discussed in the third article. It is therefore apparent that the method used for ascertaining the "time-proportion" composition of the effluent for units of the type shown in Fig. 1 must be sufficiently flexible to deal with cases where either a single unit or several vessels in series, as in Fig. 3, will comprise the continuous combining system.

For any given rate of throughput and any stated number of vessels comprising the system, it will be seen from the development in this treatise that the "time-proportion" composition of the effluent can be obtained using an easily computed characteristic of the device shown in Fig. 1, namely, the rate of turnover (or circulation) effected by the draft tube exhausting device. The mean completion of any combining phenomenon, it will be shown in the second article of this series, may be arrived at by using the "time-proportion" composition of the effluent (as determined in terms of the rate of turnover, desired rate of throughput, and the number and arrangement of the vessels used) in combination with the time vs. completion curve for the particular combining operation in question. The last factor, it should be noted, is influenced by the condition of work-input exerted on the materials in process by the "homogenizing" and the draft tube exhausting mixers shown in Fig. 1, as well as by the volume of the mixing vessel.

Table 1—Proportions Leaving and Remaining in a One-Vessel System After Various Number of Passes

Number of Passes	Proportion Leaving System	Proportion Remaining in System
1	p	$1 - p$
2	$p(1-p)$	$1 - p(1-p) - p = 1 - p - p^2 - p = (1-p)^2$
3	$(1-p)^2$	$1 - p(1-p)^2 - p(1-p) = 1 - p + p^2 - p^2 + p^3 - p + p^2 - p = (1-p)^3$
4	$p(1-p)^3$	$(1-p)^4$
n	$p(1-p)^{n-1}$	$(1-p)^n$

Table II—Proportions Leaving a Two-Vessel System After Various Number of Passes

	Vessel (1)	Vessel (2)	Proportion Leaving	Total Proportion Leaving
Two passes	1 pass	1 pass	p^2	p^2
Three passes	1 pass	2 passes	$p\,(pq)$	$2p^2q$
	2 passes	1 pass	$(pq)\,p$	
Four passes	1 pass	3 passes	$p\,(pq^2)$	$3\,p^2q^2$
	2 passes	2 passes	$(pq)\,(pq)$	
	3 passes	1 pass	$(pq^2)\,p$	

Table III—"Time-Proportion" Series for Effluent From a Continuous System Consisting of One or More Vessels in Series

	Number of Passes, n*							
	1	2	3	4	5	6	7	8	n
Number of Vessels, m	Proportion of Material Leaving Last Vessel								
1	p	pq	pq^2	pq^3	pq^4	pq^5	pq^6	pq^7	pq^{n-1}
2	..	p^2	$2\,p^2q$	$3\,p^2q^2$	$4\,p^2q^3$	$5\,p^2q^4$	$6\,p^2q^5$	$7\,p^2q^6$	†cp^2q^{n-2}
3	..	..	p^3	$3\,p^3q$	$6\,p^3q^2$	$10\,p^3q^3$	$15\,p^3q^4$	$21\,p^3q^5$	†$c'\,p^3q^{n-3}$

* Number of passes is here used as a measure of retention time.

† c and c' are the values of $\binom{n-1}{m-1}$ for the particular values of m and n.

To develop the method of analyzing the "time-proportion" composition of the effluent from one or a series of devices of the type shown in Fig. 1, the simpler device of Fig. 2 will be used. This is an idealized diagrammatic representation of the fundamental actions and structures involved in the device shown in Fig. 1. Although Fig. 2 is employed mainly because it isolates the principal factors of the device shown in Fig. 1 for quantitative evaluation, it may well be pointed out that such an assembly represents a workable continuous reactor or combiner which in some instances may be used in place of the unit shown in Fig. 1.

Comparing Figs. 1 and 2, it can be seen that the pipe loop in Fig. 2, containing a volume of material V, is analogous to the mixing vessel. The material is circulated or turned over by a pump, which is analogous to the draft tube exhausting mixer, at a rate of Q units of volume per unit of time. The feed to the device enters through a feed leg which is analogous to the inlet nozzle, then passes through that section of the piping which is marked "A", which serves functions analogous to those performed by the draft tube of Fig. 1. The orifices, across which a prescribed loss in total head is taken, function analogously to the "homogenizing" mixers.

Using Fig. 2, we may now proceed to evaluate the "time-composition" of the discharge for the cases of a single continuous mixer, as well as for a series of identical continuous mixers. The approach is through the algebra of combinations.

First, let us consider the case when a single continuous mixer is employed. If R gal. per min. is the rate of feed to the system and if, as in all cases of practical design, R is substantially lower than the circulating capacity of the draft tube exhausting mixer (Q gal. per min.), then the proportion of the effluent which will leave the system after only a single pass from the inlet to the outlet nozzle will be R/Q. Let

$$p = R/Q \qquad (2)$$

It follows then that the proportion of material remaining in the system after one pass will equal $(1-p)$; and hence the proportion of material leaving on the second pass will equal $p\,(1-p)$. Similarly, if we continue the mechanics indicated above to obtain the values of the proportions leaving at the end of three passes, four passes, to n passes, we will obtain the values set forth in Table I. If $(1-p)$ is set equal to q the series of proportions leaving the system after various numbers of passes will take the form of p for one pass; pq for two passes; pq^2 for three passes; and so on to pq^{n-1} for n passes, as shown in the first line of Table III. This is an infinite series whose summation value for all values of n, going from 1 to infinity, is 1, or:

$$\sum_{n=1}^{\infty} pq^{n-1} = 1 \qquad (3)$$

since the sum of all the proportions must equal one.

If two identical vessels are operated in series, the shortest period of stay in the system must be two passes, that is, one pass in the first vessel and one pass in the second, and the proportion of material leaving the system after such a stay is p^2. In other words, of the proportion p of one-pass material leaving the first vessel a proportion equal to

$$(p)(p) = p^2 \qquad (4)$$

will be discharged from the second vessel. There are two ways in which material may contrive to leave the two-vessel system after three passes: (1) by making one pass in the first vessel and two passes in the second; and (2) by making two passes in the first vessel and one pass in the second. If we formulate these combinations, then

$$p(p_i) + pq(p) = 2\,p^2q \qquad (5)$$

will be the total proportion of material leaving the system after a stay of three passes. In words, of the proportion p which is discharged from the first vessel after a stay of one pass, a proportion equal to pq will stay for two passes in the second vessel; while, of the proportion pq which is discharged after two passes in the first vessel, a proportion p leaves the second vessel after a stay of one pass. The sum of the stated products then equals the total material leaving the system after a stay of three passes.

There are three ways in which material can stay in the system for a period of four passes: (1) by making one pass in the first vessel and three in the second; (2) by making two passes in the first vessel and two in the second; and (3) by making three passes in the first vessel and one in the second. If we formulate these combinations, it will be found that:

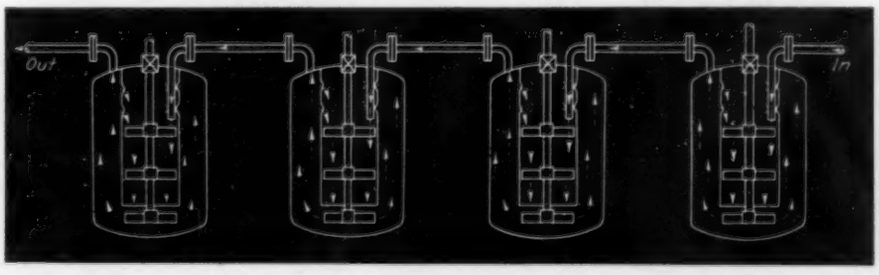
$$p\,(pq^2) + p_1(pq) + pq^2(p) = 3\,p^3q^2 \qquad (6$$

will be the total proportion of material leaving the system after a stay of four passes. These steps are summarized in Table II.

In like manner, it will be found that there are four ways in which material may remain in the system for a period of five passes; five ways for a period of six passes; and so on. If we extend the mechanics of the operations illustrated above in Equations (5) and (6) to all subsequent retentions in the system, we will obtain an infinite series in which the values indicated in the second row of Table III form the initial terms.

An exactly similar approach can be employed with a system of three identical vessels. The shortest period of retention in the system must be three

Fig. 3—A continuous combining system comprising a series of vessels



passes, and the proportion of material leaving the system after such a stay will be p^2, since the proportion p^2 which is discharged from the first two vessels after a stay of two passes (i.e., one pass through each),

$$p(p^2) = p^3 \qquad (7)$$

is discharged from the third after a stay of one pass in that vessel. For four passes we find that there are nine combinations possible in a three-vessel system and when these are set down and added together the total proportion of material leaving the third vessel will be found to equal $3\ p^3q$. For five passes in three vessels, 18 combinations are possible and the total of the proportions leaving the third vessel will be found to be $6\ p^3\ q^2$. Applying the same method of analysis to all other retentions, i.e., six passes, seven passes, and so on to n passes, we will obtain an infinite series in which the values indicated in the third line of Table III are the initial terms.

Thus sufficient explanation of the method used has been presented to show that, as in the development of "time-proportion" series for one-, two-, and three-vessel systems, the proportion of the material leaving a system of m vessels after a retention of n passes in the system is a function of m and n, and may be written:

$$\phi\ (m, n) \qquad (8)$$

By the use of operations common to the calculus of finite differences (notably by employing the concepts of difference equations and the LaPlace generating function), Brothman derived the general expression:

$$\phi\ (m, n) = \frac{(n-1)!}{(m-1)!(n-m)!}\ p^m q^{n-m} = \binom{n-1}{m-1} p^m q^{n-m} \qquad (9)$$

for all values of m from 1 to ∞ and for all values of n from m to ∞. For example, in the case of three vessels and five passes, as noted above, the proportion of material leaving the system after five passes is seen from Equation (9) to be $(4{\cdot}3{\cdot}2{\cdot}1)/(2{\cdot}1)\ (2{\cdot}1)\ p^3q^2 = 6\ p^3q^2$. Since the sum of all the proportions comprising the discharge must equal 1, as in Equation (3), we may write:

$$\sum_{n=m}^{\infty} \binom{n-1}{m-1} p^m q^{n-m} = 1 \qquad (10)$$

The existence of Equation (10) fulfills the first step in our development, namely, the task of obtaining a means of computing the "time-proportion" composition of the effluent for a system consisting of one or more units of the type shown in Fig. 1. The time of retention, it will be noted, has thus far been evaluated in terms of the number of passes or cycles executed from the point of inlet to the point of discharge in one vessel. We may now evaluate the various retentions in terms of normal time measurements by pointing out that in Fig. 2 the time t_m required for a single pass from inlet to outlet, in a vessel having a total holding capacity V, will be:

$$t_m = \frac{V}{Q} \qquad (11)$$

since a condition of the design in both Figs. 1 and 2 is that the inlet and outlet nozzles be so positioned as to make the statement as closely true as possible. All other stays or retentions in the system would then take the form of nt_m, where n is the number of passes achieved. However, it should be noted that expressions can be derived to take into account any other positioning of the inlet and outlet nozzles. The derivation of such expressions takes on a form which is demonstrated in a subsequent installment of this series. The above expressions are also predicated upon a constant-volume reaction system. Since most liquid-phase reaction systems are not characterized by appreciable deviations from constant volume, these expressions are good and sufficient for the overwhelming majority of problems encountered. The deviation of the expressions when changes in volume are involved become slightly more complicated.

Applications of Buna S Rubber

REPEATED publicity has been given to the remarkable abrasion resistance of Buna S rubber, which is the major volume synthetic in the rubber program. This synthetic, made from butadiene and styrene and known as GR-S (Government Rubber-Styrene), when properly compounded, gives a tire tread stock which is equivalent of a natural rubber tread from the standpoint of wear. In certain services it may show even superior wear resistance.

Perhaps the most serious deficiency is the tendency of GR-S stocks to crack, especially those designed by heavy compounding with carbon black and other pigments to give maximum wear. In the case of GR-S tire treads, this problem has not yet been solved. Once a cut is made by a stone or other sharp object, the cut grows very rapidly and to such a degree that failure of the tire occurs. There is apparently a structural deficiency, a lack of fiber as the rubber technologists say.

Furthermore, GR-S stocks develop more heat under flexure, that is, they have a high hysteresis loss. Neither natural rubber nor the synthetic rubbers are perfectly elastic materials, and the synthetic deviates from perfection more than the natural product.

It is this accumulation of heat that makes it necessary to use natural rubber in conjunction with the synthetic in certain applications, especially in the larger sizes of truck and military tires. In these large composite structures the maximum heat level reached is very high, for the thick tread acts as a "blanket" to prevent dissipation of heat. In some cases the over-all amount of crude required approaches 30 percent of the synthetic used.

This heat accumulation is one of the reasons for using rayon cord instead of cotton cord in the carcass of large commercial and military tires. The especially designed synthetic rayon fiber withstands higher temperatures better than the cotton fiber. Also, the rayon is much stronger, so a smaller gage cord can be used. Less rubber insulation is required and less heat accumulates. Furthermore, with the stronger cord, bruise-break likelihood is reduced.

While the larger tires require the use of natural rubber along with the synthetic and rayon is essential for long-life carcass construction, this is not true of passenger car tires. When GR-S is available for civilian use, there is every reason for expecting very satisfactory service from the all-synthetic rubber passenger car tire.

Defects of GR-S discussed above in connection with tires show up in inner tubes, but the effects are much less. Extensive development work has been done on this and very serviceable tubes are now being manufactured. They tend to chafe more than natural rubber tubes, to tear more easily, and to take on a greater permanent set which makes reapplication without pinching more difficult. It is believed, however, that these defects can be corrected.

Crack growth is serious from the standpoint of many other applications of GR-S besides tires. Conveyor belts, for example, must be crack-resistant. To what extent GR-S can be used in some of these mechanical goods applications remains to be seen.

Abstracted by the editors from an address delivered at the dedication of the Goodyear Research Laboratory, Akron, Ohio, June 22, 1943, by Norman A. Shepard, chemical director, American Cyanamid Co., and technical consultant to the Rubber Directors' Office, War Production Board.

Determining the Density of Mixed Acids

CLYDE McKINLEY *Department of Chemical Engineering, University of Michigan, Ann Arbor, Mich.*

Chem. & Met. INTERPRETATION

Mixed acid is a common nitrating agent in industrial nitration reactions. An estimation of the density of a mixed acid is often needed, and in most cases the estimation must be a guess. The author herein presents data for determination of the density of a mixed acid if the composition and temperature are known. —*Editors.*

DATA ARE presented in the ternary composition diagrams, Figs. 1 and 2, which allow the accurate determination of the density of a mixed acid if the composition and temperature of the mixed acid are known. Or if the density, temperature, and the concentration of one of the constituents in the mixed acid are known, the concentrations of the other two constituents may be estimated.

In the construction of Fig. 1, the data available in the literature[1, 2] and the author's data (Table I) for the density (grams per cubic centimeter) of mixed acids at 25 deg. C. were plotted on a triangular ternary composition diagram and lines showing constant density were drawn.

Temperature coefficients for the density of mixed acids have been calculated from mixed acid density measurements at 20 deg. and 30 deg. C.[1, 2] These factors were plotted in Fig. 2 to obtain the lines showing the effect of temperature upon density.

Temperature coefficients shown in Fig. 2 are equal to the change in the third significant figure to the right of the decimal point for a change in temperature of 1 deg C.

USE OF FIGURES

Use of Figs. 1 and 2 is illustrated by determining the density of a mixed acid which contains 30 percent nitric acid, 40 percent sulphuric acid, and 30 percent water and is at 35 deg. C. This acid composition is located in Fig. 1 at point *A* and the density at 25 deg. C. is found to be 1.528 grams per cubic centimeter. This value must be corrected to 35 deg. C. by the use of a temperature coefficient obtained from Fig. 2. The above acid composition is located in Fig. 2 at point *B* and the factor for this acid is found to be 1.18. The density at 35 deg. C. is less than the density at 25 deg. C. and so equals $1.528 - (10 \times 0.00118)$ or 1.516 grams per cubic centimeter.

Dissolved impurities such as lead sulphate, calcium sulphate, and nitrous acid[3] increase the density of mixed acids. Sufficient data are not available for accurate estimation of the densities of impure mixed acids but the qualitative effect of impurities should be kept in mind.

Table I—Density of Mixed Acids at 25 Deg. C—Grams per Cubic Centimeter

Weight Percent				
H_2SO_4	HNO_3	H_2O	HNO_2	Density
0.0	66.6	33.4	0.0	1.390
0.0	69.9	30.4	0.0	1.405
0.0	62.83	37.17	0.0	1.374
18.69	50.84	30.47	0.0	1.4575
26.77	40.10	33.13	0.0	1.4645
28.83	33.37	37.80	0.0	1.490
30.08	29.18	40.74	0.0	1.4215
38.37	29.4	32.23	0.0	1.501
42.56	21.17	36.27	0.0	1.483
48.55	23.16	28.29	0.0	1.5535
49.85	18.62	31.53	0.0	1.536
53.38	10.50	36.12	0.0	1.511
53.52	23.78	22.70	0.0	1.6095
55.40	21.00	23.6	0.0	1.610
57.37	14.78	27.85	0.0	1.586
57.62	14.80	27.58	0.0	1.592
57.5	15.06	27.44	0.0	1.591
58.5	27.6	13.9	0.0	1.685
58.8	22.11	19.09	0.0	1.650
59.58	10.65	29.77	0.0	1.576
61.21	7.84	30.95	0.0	1.570
62.43	4.12	33.45	0.0	1.5535
63.25	12.94	23.81	0.0	1.639
63.46	13.88	22.66	0.0	1.641
63.21	18.41	18.38	0.0	1.671
65.32	13.93	20.75	0.0	1.665
66.98	6.80	26.22	0.0	1.627
68.43	9.42	22.15	0.0	1.664
0.0	61.3	38.41	.292	1.366
0.0	62.68	36.97	.35	1.376
0.0	59.07	40.66	.268	1.3585
21.69	41.72	36.37	.215	1.433
29.74	31.05	39.15	.057	1.430
30.38	28.16	41.43	.033	1.418
28.56	34.22	36.89	.329	1.446
41.46	22.09	36.28	.168	1.480
43.79	18.18	37.94	.056	1.469
52.88	11.22	35.68	.217	1.5095
53.32	12.06	34.28	.343	1.520
53.39	11.36	34.82	.428	1.521
53.91	9.89	35.95	.243	1.512

Fig. 1—Density of mixed acids at 25 deg. C. (grams per cubic centimeter)

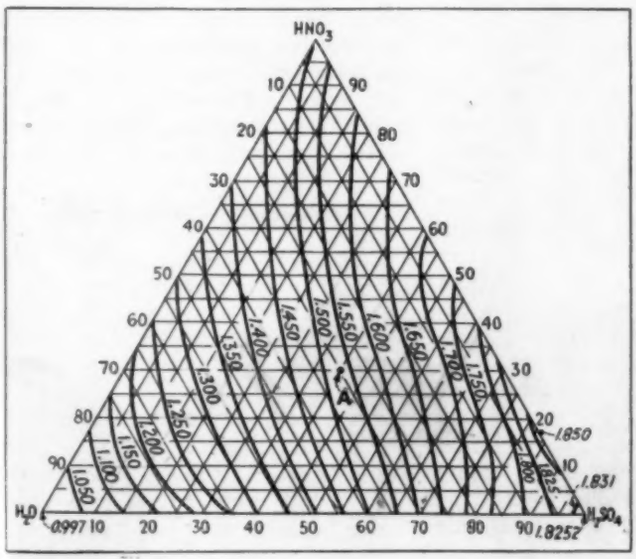
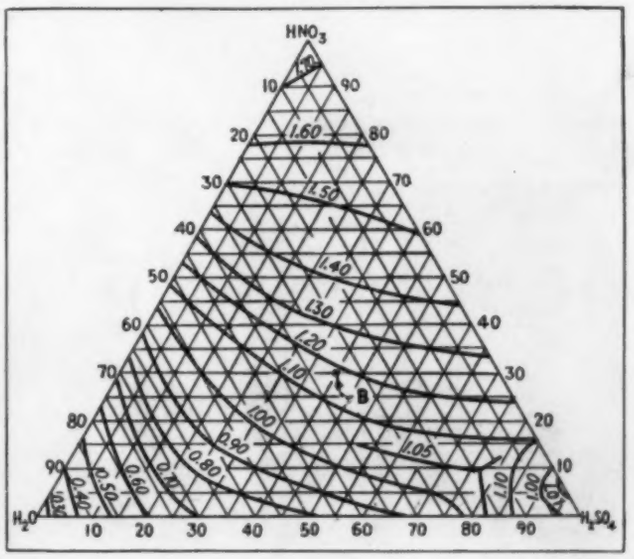


Fig. 2—Temperature coefficient of density for mixed acids (0.001 per deg. C.)



H_2SO_4	Weight HNO_3	Percent H_2O	HNO_3	Density
53.36	10.22	36.09	.326	1.5075
54.28	9.91	35.49	.32	1.510
54.6	7.57	37.77	.055	1.500
54.95	9.35	35.32	.37	1.519
59.05	10.95	29.94	.06	1.578
61.16	6.37	32.21	.263	1.5628
61.6	4.92	32.97	.512	1.5572
61.7	4.35	33.68	.272	1.5532
61.17	7.19	31.44	.195	1.5685
61.48	6.28	32.02	.217	1.568
62.12	5.46	32.27	.148	1.562
62.29	4.31	33.09	.313	1.559
62.41	4.53	32.85	.21	1.562
62.42	4.34	32.99	.243	1.559
62.45	4.11	33.20	.241	1.557
62.07	4.63	33.10	.196	1.555
62.37	3.69	33.67	.27	1.558
62.49	3.70	33.58	.227	1.5515
62.83	1.66	35.18	.33	1.548
62.88	4.25	32.42	.45	1.567
63.0	2.67	34.14	.197	1.549
63.17	1.99	34.48	.363	1.5516
63.17	3.36	32.79	.68	1.558
63.18	3.87	32.42	.531	1.559
63.23	3.77	32.46	.543	1.564
63.2	3.05	32.94	.806	1.5605
63.46	1.58	34.78	.19	1.5455
63.53	2.25	34.08	.144	1.5495
63.76	1.34	31.84	.064	1.546

H_2SO_4	Weight HNO_3	Percent H_2O	HNO_3	Density
64.2	3.42	31.98	.392	1.5695
68.26	1.75	29.81	.18	1.606
68.35	2.07	29.44	.14	1.603
68.83	.85	30.32		1.602
69.1	.34	30.45	.106	1.599
69.06	7.62	23.22	.099	1.664
67.3	6.00	26.60	.094	1.626
69.6	1.66	28.67	.065	1.616
70.1	.18	29.68	.044	1.606
71.3	2.85	25.78	.071	1.644
71.65	2.46	25.70	.093	1.641
72.05	.14	27.73	.082	1.635
72.06	.29	27.60	.052	1.6355
72.11	.21	27.62	.06	1.634
72.12	.113	27.74	.022	1.6325
72.31	.136	27.49	.063	1.632
72.8	.13	27.04	.029	1.637
72.87	trace	27.13	trace	1.6405

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Plastic Pipe for Rectifiers

Chem. & Met. INTERPRETATION

One of the newest and most interesting electrical applications for saran plastic is the installation of nearly 4,000 feet of saran pipe and fittings on heat exchangers and rectifying units at the new Dow Magnesium Corp. plant in Michigan, described in this article.—*Editors.*

SARAN is a thermoplastic developed by The Dow Chemical Co. and produced in many diversified forms, including saran pipe and fittings. Produced by modified extrusion, saran plastic pipe has a smooth, cylindrical shape resembling in appearance metal pipe of comparable dimensions. Saran pipe possesses distinctive properties such as toughness, durability, long life and a high degree of chemical, corrosive and scale resistance that make it of value to electrical, oil, gas, water, and chemical processing industries.

Close-up view of saran plastic pipe and fittings showing connection to the rectifier

One of the newest and most interesting electrical applications for saran plastic is the installation of nearly 4,000 feet of saran pipe and fittings on heat exchangers and rectifying units in the rectifier stations at a new Dow Magnesium Corp. plant in Michigan.

In the process of rectification from 13,800 volts a.c. to 600 volts d.c. certain power losses occur in the form of heat. This heat is absorbed by water in jackets on each of the several rectifier units and is carried by means of a closed circuit, water-circulating system to the heat exchangers on the floor below by means of saran pipe. Water from the river is used in the heat exchangers to pick up the heat and carry it away. The excellent electrical insulation of saran pipe prevents the 600-volt potential of the rectifier water jackets from being grounded through the heat exchangers to the river water piping system. The water flows from the rectifier jackets to the heat exchangers through saran pipe at temperatures varying from 140 deg. F. to 160 deg. F., and returns at approximately 85 deg. F.

Saran's resistance to corrosion proves valuable in preventing scaling or fouling in the rectifier jacket. The full significance of this characteristic will be appreciated when it is realized that the scaling or fouling of jackets necessitates dismantling of the whole rectifier to locate the trouble. The life expectancy of saran pipe far exceeds that of rubber pipe which was formerly used.

Saran pipe can be quickly set up under exceptionally difficult circumstances because of semi-flexibility and a wide range of fittings which are injection molded. Fittings are available in standard dimensions to match pipe sizes and include ells, tees, return bends, couplings, reducers, nipples, and bushings. Both blind and open pipe flanges have convex surfaces, a feature which eliminates use of gaskets.

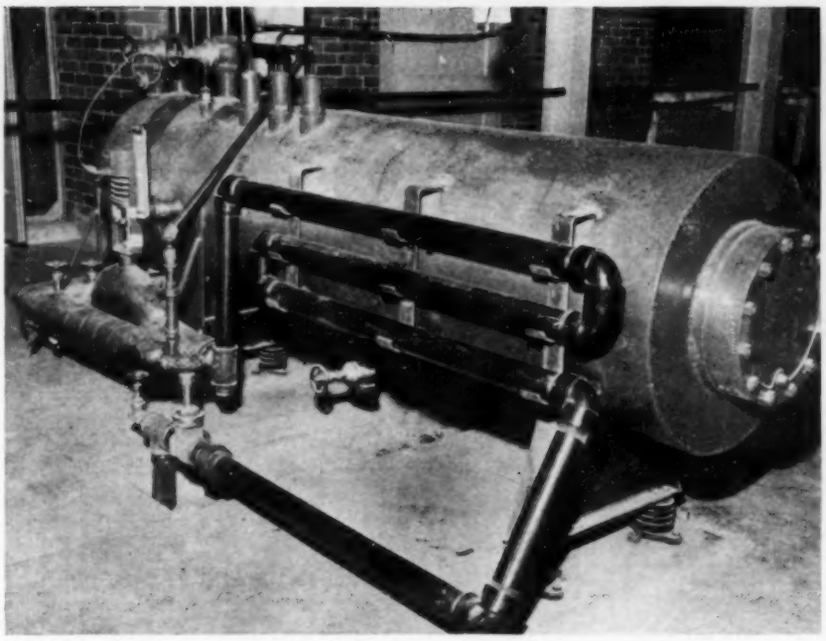
Saran pipe can be cut to size quickly and welded on the job within one minute by employing a portable nickel or chromium surfaced plate which is heated to 400 deg. to 500 deg. F. The pipe ends are placed against it until a molten bead of material is visible on the outside of the ends. Pressed together firmly in proper position and allowed to cool, the joint strength becomes equal to that of the pipe. Final joints can be welded into position after erection.

Another application is the use of saran sheet as an insulator in the same plant to prevent a "short circuit path." When the magnesium cells are in operation, heavy leakage currents may travel to ground through the walls of the building. To prevent this loss, a layer of $\frac{1}{16}$ in. to $\frac{1}{2}$ in. saran sheet was placed between the bricks of the walls, about six feet above the ground, and between the metal joints and beams at other places in the building during construction.

If it were not for this insulation, a great amount of electrical energy would be wasted, accompanied by deterioration and corrosive destruction of metal pipes, reinforcing bars, and other equipment. In this instance, saran accomplishes maximum efficiency, saving in materials, and repair costs. This material was chosen because of its being able to replace rubber and its value in preventing corrosion and scale.

Characteristics of Saran Pipe

Nominal Size	O.D.	I.D.	Calc. lb./ft.	Calc. Burst. Pressure lb./sq. in.	Working Pressure lb./sq. in.
0.05	0.840	0.546	0.236	1300	260
0.75	1.050	0.742	0.320	1060	210
1.00	1.315	0.957	0.475	970	190
1.25	1.660	1.278	0.650	820	160
1.50	1.900	1.500	0.790	740	150
2.00	2.375	1.939	1.09	620	125
2.50	3.875	2.277	1.805	570	115
3.00	3.500	2.842	2.480	510	105
3.50	4.00	3.307	3.010	470	95
4.00	4.500	3.749	3.760	460	90



Heat losses picked up by rectifier jackets on the floor above are carried through saran pipe to this heat exchange unit for cooling and disposition

Hexamine for Blockbusters

Chem. & Met. INTERPRETATION

Details of the manufacture of the principal high explosive that makes the so-called "blockbuster" bombs so devastating cannot be revealed at this time. It is interesting, however, to learn that the du Pont Perth Amboy plant has just won the Army-Navy "E" for manufacture of hexamine, one of the chief ingredients of this explosive.—*Editors.*

HEXAMINE (or chemically, hexamethylenetetramine) has recently been announced as one of the basic ingredients for the manufacture of the super-high explosive used in the so-called "blockbuster" bombs now being dropped so liberally upon the Ruhr district of Germany. In fact, the recent Army-Navy "E" for the du Pont Perth Amboy plant, the first such award under the sponsorship of the Treasury Department, was primarily in recognition of this plant's production of hexamethylenetetramine for conversion into explosives.

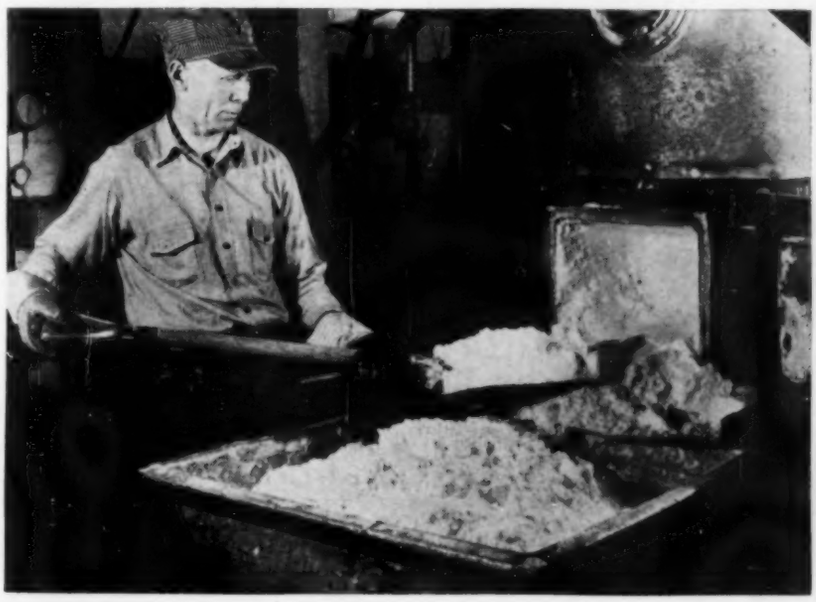
Hexamine, made for many years at this and other plants in the country, was formerly used principally in industry in the manufacture of phenol-formaldehyde plastics. It also is vital to the manufacture of certain pharmaceuticals.

Since the present war broke out the high explosive for "blockbusters" has been developed, which requires large quantities of a special grade of hexamine. The size of granulation, moisture content and other properties had to be changed and closely governed. The required explosives grade was developed at this du Pont plant, working in cooperation with another nearby du Pont explosives plant, and now is used wherever the explosive is made in this country and abroad. Other large plants for manufacturing hexamine have been constructed to supply America's immense explosive requirements. Some of these new plants pattern their process directly from that at Perth Amboy. These new plants are supplying domestic explosives works, while most of the production from Perth Amboy now is shipped under lend-lease. The exact quantity shipped, which is substantial, cannot be revealed at this time.

Hexamine is made from ammonia and formaldehyde raw materials. The ammonia is shipped to Perth Amboy from a West Virginia plant of du Pont, while the formaldehyde is made at the Perth Amboy plant itself. The liquid formaldehyde and the liquid ammonia are pumped into a reactor where, under controlled conditions, hexamine is formed in solution. The solution passes into an evaporator, where it is concentrated into a white, crystalline substance which looks and feels like sugar. This substance is dried, ground to proper granulation and shipped in powder form. Sometimes the hexamine is redissolved, recrystallized and thereby purified for use in the pharmaceutical industry.

Prior to the war, this was one of the two largest formaldehyde plants in America. At that time it supplied a substantial percentage of the material going into phenol- and urea-formaldehyde plastics. Today it continues to supply some of the largest plastic material manufacturers, as well as converting many times as much formaldehyde into hexamine as it did before the outbreak of the war.

Here crystalline hexamine is being removed from the evaporator for drying



PLANT NOTEBOOK

CHART FOR CALIBRATING HORIZONTAL TANKS WITH STANDARD OR NON-STANDARD DISHED ENDS

D. G. WILLIAMS *Chief Engineer, Trojan Powder Co., Allentown, Pa.*

THE CHART presented herewith was calculated by the writer's associates, P. T. Frankenfield, P. C. Seaton and T. G. Marshall. In its original size it is capable of a high degree of accuracy. In reducing for reproduction here, some of its accuracy has necessarily been sacrificed, partly because of the need for dropping the finely divided grid, and partly because it has been necessary to omit each alternate curve of the original for clarity in the smaller size. It is still capable of a good degree of accuracy, however, comparable with other types of chart for tank calibration.

As an example of the use of the chart, assume a tank of 10 ft. diameter, 30 ft. long, having convex heads of radius equal to the tank diameter and filled to a depth of 75 in. The problem is to find the volume of liquid in the tank. On Scale (2) find 75 in. (point x) and from this point go left to intersect the line marked 120-in. Diam. Tank at point x_1. Then go upward to intersect the curve marked Tank Head R=1.0d at point x_2. Then go right to intersect the solid line marked 120-in. Diam. Tank at point x_3, and go upward to Scale (4) at point x_4, where the volume of liquid in one head is read as 38.0 cu. ft. Then from point x_3 continue upward to intersect the curve marked "Capacity Curve, Horizontal Cylindrical Tank"; at point x_5. Then go right to intersect the dotted line marked 120-in. Diam. Tank at point x_6. Then go upward to Scale (6) at point x_7, where the volume of liquid per lineal foot of tank section is read as 51.75 cu.ft.

The total volume of liquid in the tank is then equal to 2×38.0+30×51.75= 76.0+1,552.5=1,628.5 cu.ft. of liquid in the tank.

The intervals between the percentage depth scales are linear, and so interpolations can be made here directly. The intervals between the remaining scales are non-linear and the easiest way to interpolate accurately is to plot the intervals along a given line against a linear scale, thus making the interpolation on the auxiliary curve so obtained.

Cylindrical Tank (Flat Ends), Capacities For Different Depths of Liquid in Terms of Cubic Feet Per Ft. of Length, Scale 6
Bulged Tank End, Capacities For Different Depths of Liquid in Terms of Cubic Feet Per End, Scale 4
Capacity curve, horizontal cylindrical tank
Tank head R=0.5d
120" dia. tank
132"
144" dia. tank
Tank head R=0.6d
Tank head R=0.8d
" " R=1.0d
" " R=1.3d
" " R=1.5d
" " R=1.75d
" " R=2.0d
" " R=2.25d
36" dia. tank
48" " "
60" " "
72" " "
84" " "
96" " "
108" " "
120" " "
132" " "
144" " "
Note:- R = 4h² x d² / 8h
Cylindrical Tank (Flat Ends), Capacities For Different Depths of Liquid in Terms of d³ Per Ft. of Length, Scale 5
Bulged Tank End, Capacities For Different Depths of Liquid in Terms of d³ Per End, Scale 3
Depth of Liquid in Tank in Inches, Scale 2
Depth of Liquid in Percentage of Tank Diameter, Scale 1

CHEM & MET REPORT ON . . .

Centrifugal Separation in Process Industries

Unit operations of the group dealing with separations of solids from liquids and liquids from liquids comprise the most extensive classification in the entire unit operations list, and often involve the most troublesome problems of selection met by chemical engineers. The present report takes up the class of equipment which effects such separations by centrifugal force (not including dry-type centrifugal separators). Although it attempts to cover briefly all liquid-liquid and liquid-solid centrifugal separators used in the process field, its chief function is to discuss the newer types and to show the sorts of operation for which they are being used.

A CENTRIFUGAL or centrifuge is a machine designed to exert centrifugal force upon a mixture in order to effect a separation of solids from liquids, or liquids from liquids, or to classify solids according to particle size or specific gravity. In other words, it is a machine designed to accomplish at high speed the same sorts of separation which can be accomplished by gravity at lower rates. Owing to the fact that the separating force may be tremendously multiplied as compared with the force of gravity, it is also possible by means of centrifugals to accomplish separation of materials so finely divided that they would never separate by gravity subsidence, as well as of emulsions and even some colloidal suspensions which also could not be separated by gravity alone.

The effect of centrifugal force is exactly similar to that of gravity except that it may be made much greater; that it acts radially from a center of rotation instead of in parallel lines; and that its magnitude varies with the distance of the particle acted on from the center of rotation, instead of being constant as in the case of gravity. Centrifugal force is directly proportional to the radius of rotation and to the square of the velocity of rotation. That is, $F = KN^2r$, where F is the force "times gravity," K is 0.0000284, N is the number of revolutions per minute and r is the rotational radius in inches.

How this force will affect the settling rate of a suspended particle can be inferred from a consideration of Stokes' Law which expresses the settling velocity of a particle suspended in a quiescent liquid. Stokes' Law states that $V = 2r^2(s_2 - s_1)g/9\mu$ where V is the settling velocity, r is the radius of the particle, s_2 is the specific gravity of the particle, s_1 is the specific gravity of the liquid, g is the accelerating force (gravity) and μ is the viscosity of the liquid.

It is obvious from a consideration of this formula that the settling velocity in a tank can be increased by increasing the particle size, increasing the specific gravity difference, increasing the accelerating force, or reducing the liquid viscosity. For example, flocculation of the particles increases the effective particle size while heating reduces the liquid viscosity and generally increases the gravity difference by reducing the specific gravity of the liquid.

Still another method of decreasing settling time is available, which is to decrease the depth of the liquid. This method likewise can be employed in tank settling, but none of these expedients is as effective as the increase in accelerating force which can be employed when centrifugal force is substituted for gravity. Although in centrifugal separation it is ordinarily impossible to effect an increase in particle size through flocculation owing to turbulence in the machine intake, the material to be processed is frequently heated to reduce viscosity and increase the specific gravity difference. In some types of machines the settling distance is made as small as possible to decrease settling time. However, chief reliance for rapid operation is placed on increase in the accelerating force which is seldom less than 400 times gravity in the largest diameter machines, and has been made more than 1,000,000 times gravity in extremely high-speed research-type centrifugals.

One more important point in the design of centrifugal separation equipment should be considered before passing to a discussion of specific types. That is the mechanical factor of stress in the bowl of the machine. Bowl stress in a centrifugal is proportional to the peripheral speed which in turn is proportional to the first power of the rotational speed. The separating force, on the other hand, is proportional to the first power of the bowl radius and to the square of the rotational speed. The practical effect of this consideration is that to avoid unduly high stresses, large-diameter bowls can be operated only at relatively low speeds, producing comparatively low separating force. For the same bowl stress, the smaller the diameter of the bowl, the more rapidly it can be rotated and the higher the force it will produce. Thus, a 40-in. basket at 1,200 r.p.m. will give a separating force of 800 times gravity, while a 6-in. bowl at 15,000 r.p.m. will generate nearly 20 times this force, with less than twice the peripheral speed. Such enormous forces are not always necessary, however, and for other practical reasons there are many uses for large-diameter, slow-speed centrifugals, as well as for those of intermediate size and speed.

There are two ways in which a separation can be effected by centrifugal force: By an operation comparable to tank settling (or settling plus draining); or by an operation comparable to filtration. All centrifugals operate on one principle or the other. Small-diameter industrial machines are always of the first type, employing a solid or imperforate tubular or cylindrical bowl. Large-diameter machines of the batch or automatically operated semi-continuous type are most often of the second class with perforate, filtering-type baskets, although large-diameter imperforate baskets also are employed for certain types of separation. In the first class of separation, the mixture of liquids, or liquids and solids, is caused to stratify under the application of centrifugal force, and the separated components are either drawn off as the machine operates,

or later removed by cleaning the bowl. In the second class, solids are collected on the surface of the basket, which is covered with a suitable filtering medium, while the liquid passes through the accumulation of solids and through the filter medium, being caught in an annular casing or curb.

In the past the filtering type has generally been considered as the only suitable centrifugal equipment for separating large quantities of liquids and solids when the latter are of relatively free-filtering type. In recent years, however, it has been found that the continuous solid-bowl type is equally as well suited for many sorts of operation as the perforate basket machines which were formerly used.

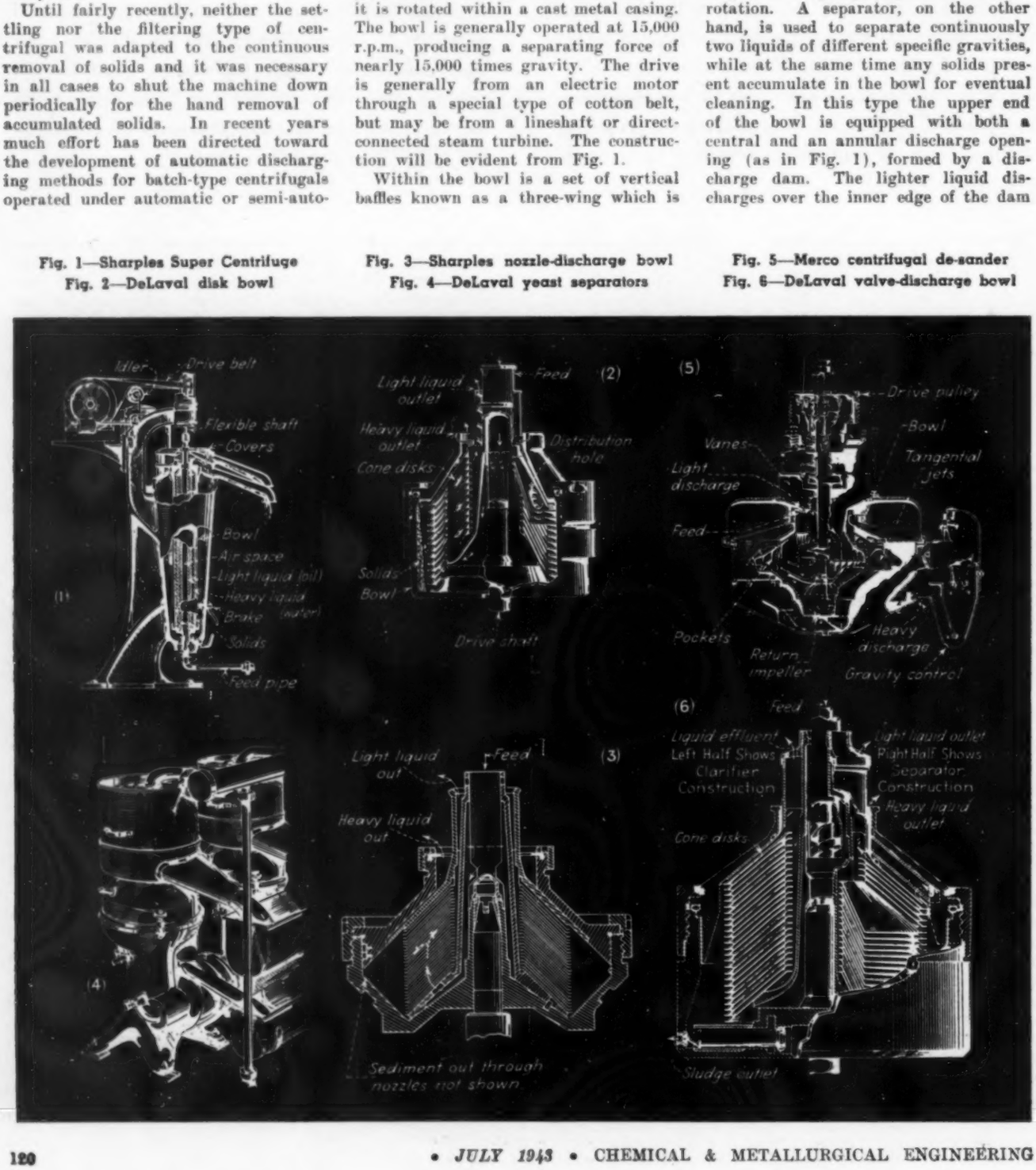
Until fairly recently, neither the settling nor the filtering type of centrifugal was adapted to the continuous removal of solids and it was necessary in all cases to shut the machine down periodically for the hand removal of accumulated solids. In recent years much effort has been directed toward the development of automatic discharging methods for batch-type centrifugals operated under automatic or semi-automatic cycle control; and toward the production of machines capable of discharging large quantities of solids on a continuous basis.

TUBULAR BOWL MACHINES

Of the small-diameter centrifugals, the type which operates at the highest speed is the tubular-bowl machine which is typified by the Super Centrifuge manufactured by the Sharples Corp. This machine consists essentially of a solid tubular bowl 6 in. in diameter, or less, and several feet in length, which is supported in a vertical position by a flexible shaft and thrust bearing, the bottom being loosely guided by means of a spring-mounted bushing. The feed is jetted into the bowl at the bottom as it is rotated within a cast metal casing. The bowl is generally operated at 15,000 r.p.m., producing a separating force of nearly 15,000 times gravity. The drive is generally from an electric motor through a special type of cotton belt, but may be from a lineshaft or direct-connected steam turbine. The construction will be evident from Fig. 1.

Within the bowl is a set of vertical baffles known as a three-wing which is placed loosely in the bowl and serves to bring the material entering at the bottom immediately up to bowl speed. As the material enters, it is, of course, immediately thrown to the bowl wall where, in accordance with Stokes' Law, modified by the large separating force available, the material of higher specific gravity seeks the wall, forcing the material of lower specific gravity toward the center. There are two principal variations in this bowl, one type known as the clarifier, and the other as the separator. In case the bowl is to be used solely for clarification (i.e., separation of a comparatively small amount of solids from a single liquid), the upper part of the bowl is equipped with a single discharge opening at the axis of rotation. A separator, on the other hand, is used to separate continuously two liquids of different specific gravities, while at the same time any solids present accumulate in the bowl for eventual cleaning. In this type the upper end of the bowl is equipped with both a central and an annular discharge opening (as in Fig. 1), formed by a discharge dam. The lighter liquid discharges over the inner edge of the dam

Fig. 1—Sharples Super Centrifuge
Fig. 2—DeLaval disk bowl
Fig. 3—Sharples nozzle-discharge bowl
Fig. 4—DeLaval yeast separators
Fig. 5—Merco centrifugal de-sander
Fig. 6—DeLaval valve-discharge bowl



and into one discharge cover, while the heavier liquid discharges through the annular opening between the outer edge of the dam and the tubular bowl wall, flowing into a separate discharge cover.

In one form of bowl continuous discharge of solids is accomplished by floating them on a heavier liquid. For instance, in recovering refined vegetable oil from the soap produced during the refining, a soap-oil-water emulsion is obtained. When this is treated with salt and passed through the centrifuge, the brine goes to the wall and the salted-out soap floats on the brine and discharges with it, while the oil discharges from the center opening. In petroleum refining a similar process is used in which wax is caused to precipitate from the oil by chilling and is removed from the centrifuge on a film of water which is maintained against the bowl wall.

Several modifications of the Super Centrifuge have been developed for special purposes. For example, to prevent contact of the air with the liquid being processed, the machine can be equipped with a vapor-tight housing which incloses the bowl and discharge covers. This construction is suitable for use with flammable liquids which might form an explosive mixture in contact with the air. For moderate vapor-tightness another type is made having tight-fitting covers which are provided with liquid seals instead of the usual discharge sprouts.

Tubular-bowl centrifugals are being employed in a great many different types of applications. Oils of many kinds, such as fish oils, high vitamin oils, citrus fruit oils, insulating oils, vegetable oils and creosote oils are being clarified and dehydrated in such equipment. They are being used in the clarification and separation of many chemicals, in the manufacture of serums and vaccines, in the preparation of blood plasma and many pharmaceuticals. Rubber latex is being clarified and concentrated, petroleum oils de-waxed and separated from acid sludge, paints, varnishes and lacquers clarified, and contaminated lubricating oils recovered by such machines.

DISK BOWL CENTRIFUGALS

In the discussion of Stokes' Law it was pointed out that one method of decreasing settling time is to decrease the depth of liquid through which subsidence must take place. In the tubular bowl machine just discussed, this is accomplished by making the bowl of relatively small diameter, that is, 6 in. or less. Another extensively used device is the employment of a bowl of somewhat larger diameter, operated at a lower speed (up to 6,000 r.p.m.), within which is a stack of conical disks spaced at intervals which are generally two or more times the diameter of the largest particle or liquid globule to be separated. This type of separator is now used in by far the largest number of machines in existence and is based largely on the design originated in 1878 by DeLaval. A typical disk bowl of this type, manufactured by the DeLaval Separator Co., is shown in Fig. 2.

Referring to this drawing, it will be noted that feed flows down a central tube past vanes which accelerate it to bowl speed. It then flows outward and up through several columns of feed holes through the disks. During this upward flow its tendency is to be thrown outward between the disks, but the heavier material crowds out the lighter material, forcing the latter back toward the center. Since the radial distance between disks is small, the material passing outward very soon strikes the next higher disk and then moves over the disk surface toward the sediment space. In so doing any intrained lighter material is squeezed out and moves inwardly, while the heavier material intrained with the lighter likewise is given an opportunity to escape and move outwardly. The position of the feed holes in the disks is determined by which liquid it is desired to free more completely from the other. In a cream separator, for example, the feed holes are near the center so as to give the longest travel possible to the heavier component, the skim milk, and thus to separate the butter fat from it as completely as possible.

Disk bowl machines, too, are built both as clarifiers and as separators. In a clarifier the object is to remove a comparatively small amount of solids from a single liquid and for this purpose the passage at the top of the disk stack in Fig. 2, which is provided for carrying the heavier liquid to its discharge, is blanked off. Hence all liquid is forced to travel inwardly between the disks, while the solid material travels outwardly and collects in the bowl. In a separator, the object is to separate two liquids and usually also a relatively small amount of solids. Then the construction is as shown in Fig. 2.

In disk bowl centrifugals the bowl is mounted within a cast housing provided with one or more covers for recovery of the separated liquid or liquids. The bowl is supported on a vertical shaft driven by spiral gearing from a horizontal motor which accelerates the load through a centrifugal clutch. In some modifications, as in the case of the tubular machine, the centrifugal is made vapor-tight. In one modification it is fed from the bottom through a hollow shaft in order that the lighter liquid may be taken out at the exact center of rotation and thus avoid foaming and turbulence to the maximum possible extent.

Owing to the comparatively small solids holding capacity of the disk type of bowl, in recent years there has been considerable interest in the development of self-cleaning types of bowl. This has taken two directions: a type equipped with nozzles through which all of the solids (plus a small proportion of the liquid) discharge continuously; and a second type employing peripheral valves in the bowl which open automatically as often as a certain volume of solids has accumulated. There are at present on the market two principal variations of the nozzle-discharge type.

One variation, for large-volume concentration operations, will be discussed later. The second type, shown in Fig. 3, is the particular design of the Sharples Corp., but is similar also to that built by the DeLaval Separator Co. It is suitable for the purification of a single liquid containing sediment, as well as for the separation of two liquids also containing sediment. It is being employed primarily in fish oil recovery and in the clarification and dehydration of citrus oils. In Fig. 3 it will be observed that the design of the bowl is substantially that of Fig. 2 except that the periphery of the bowl is equipped with a number of small tangential nozzles through which the sediment continuously discharges. This type is suited to those applications where the loss of a certain amount of liquid with the solid is not disadvantageous. Where this loss must be considerably decreased, the type of bowl shown in Fig. 6 is now being used to a considerable extent. One special variation of the nozzle discharge type of bowl which has enjoyed extensive use is the yeast concentrator. The type manufactured by DeLaval is illustrated in Fig. 4.

RECIRCULATING MACHINES

Fig. 5 shows one of several modifications of the Merco nozzle-type centrifugal separator manufactured by the Merco Centrifugal Co. The modification shown is used as a de-sander for the removal of cuttings from oil-well-drilling mud. In another modification, similar except that the vertical vanes in the bowl are replaced by a stack of conical disks, the machine is used to concentrate solid material in a small amount of liquid, for example, in the removal of excess water and colloidal material from the barytes weighting used in drilling mud. In still another modification, which is more nearly similar in principle to the centrifugal of Fig. 3, the Merco is used for removing starch from gluten or gluten from starch in the cornstarch industry.

In Fig. 5, operation is as follows: The bowl is driven by a vertical motor and V-belt at a speed giving a separating force of about 500 times gravity. Material is fed at the top around the shaft and passes through an impeller which brings it up to bowl speed and throws it out radially between the vertical vanes. Solid material, or rather a concentrate of the solid in the the liquid, accumulates in the pockets at the periphery of the bowl and flows continuously from a number of backwardly tangential nozzles. This material drops into the bottom of the casing where it is picked up by the return impeller and recirculated through the bowl. A part of the discharge from the nozzles goes through a counterbalanced density control bucket which balances at a height depending on the weight of the material in the bucket. This determines what

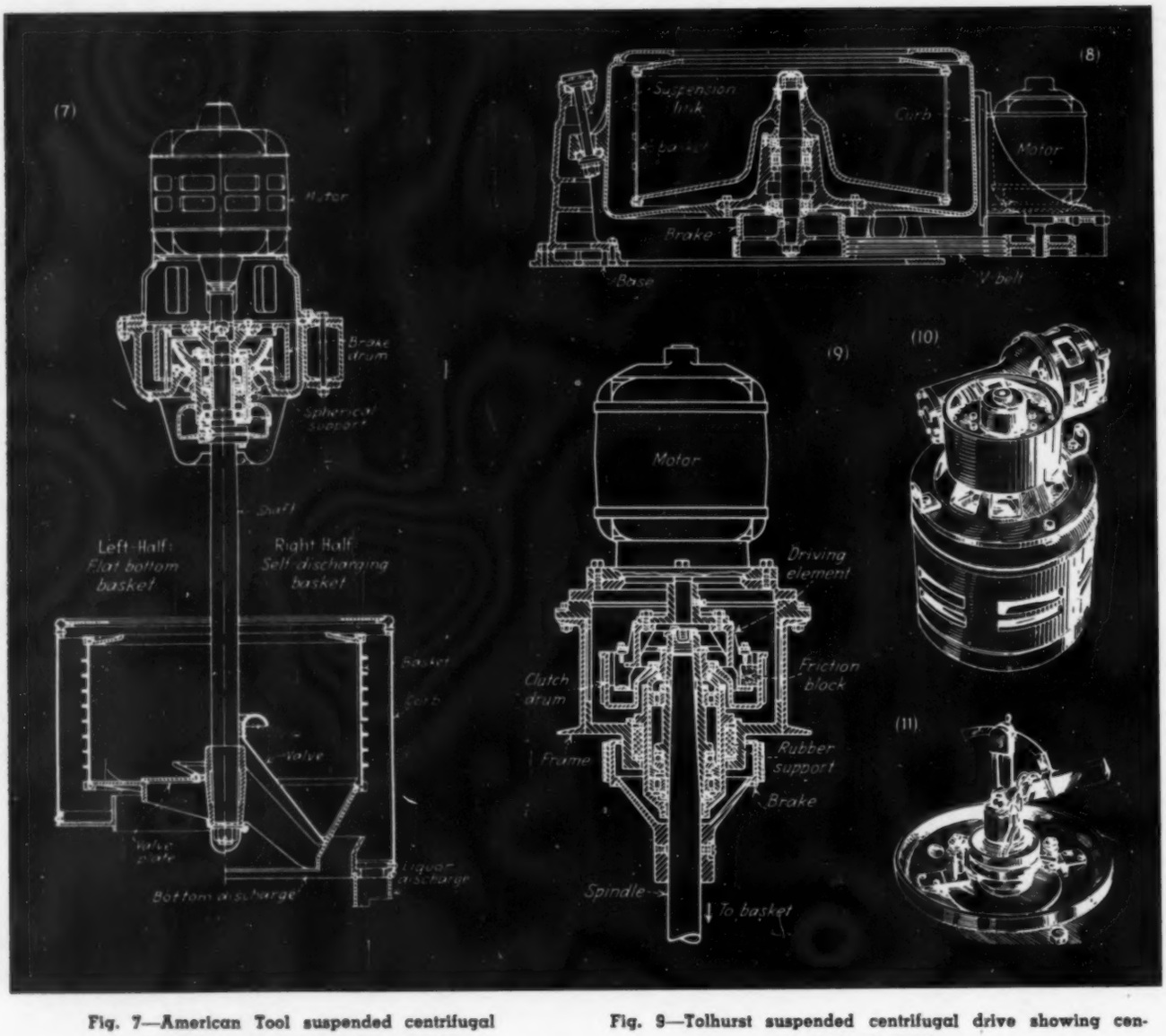


Fig. 7—American Tool suspended centrifugal
Fig. 8—Tolhurst link-suspended centrifugal
Fig. 10—American Tool free-wheeling drive

Fig. 9—Tolhurst suspended centrifugal drive showing centrifugal clutch
Fig. 11—Fletcher Centroid speed control switch

proportion will be discharged from the machine, and what proportion will return to the casing. In this way the quantity recirculated can be regulated automatically to exert a control over the density of discharged material. The effect of recirculation is to permit the same material to be acted upon as many times as may be necessary, and also to permit the use of larger nozzle openings without the plugging danger inherent in small openings. The liquid which has been freed from the solid, as in the case of other nozzle discharge centrifugals, moves back toward the center and discharges into the upper part of the casing.

In the second modification of this machine mentioned above, the liquid passes between cone disks before discharging, giving a better opportunity for final separation of finely divided solids. In the modification used in the starch industry the feed is jetted into the bottom of the rotor where it is set in rotation by vanes above the feed nozzle. It climbs a conical wall and then passes into a separating chamber outside a nest of conical disks. The heavier solids are projected outwardly by centrifugal action and leave the rotor through tangential nozzles. The bulk of the liquid and the lighter solids flow back toward the center through the nest of disks and are discharged at the bottom of the rotor into a volute from which they leave the machine. On leaving the nozzles the heavier solids retain enough kinetic energy to build up a head which will lift them back into the rotor near the top for recirculation of a part of this fraction. The remainder leaves the machine as the heavier component. Wash water (which is required in separating starch and gluten) enters with the recirculating material.

It was mentioned above that instead of nozzles, some self-cleaning disk-bowl centrifugals are equipped with peripheral valves for semi-continuous discharge of accumulated solids. Such a bowl is shown in Fig. 6 which, although it is the specific design of DeLaval Separator Co., is similar in general principle to the valve bowl built by the Sharples Corp. This type is employed for clarifying a single liquid containing insoluble impurities, or for separating mixtures of two liquids when solids are also present. Its operation is similar to that of any other disk bowl separator except that, as solids accumulate, the valves open slightly to permit discharge of a part of the accumulated sediment. Then, before all of the sediment is removed, the valves close so as to prevent the discharge of an excessive amount of liquid. It should be noted that the left half of Fig. 6 shows the type of construction which is employed for a clarifier, while the right half shows the construction employed for a separator. Although not shown, the right half is also equipped with valves. The construction of the valves is such that liquid is allowed to leak through slowly until the entrances to the valve chambers become sealed by accumulated solids. When the liquid in one of the valves leaks out, thus diminishing the pressure, the sludge forces the floating valve open and flows out through the orifice until the valve

again fills with liquid and reseats itself, continuing the cycle. Bowls of this type are used in the simultaneous purification and dehydration of wool grease and in the dehydration of coke-oven tar.

BASKET CENTRIFUGALS

Most large-diameter centrifugals, as noted above, are of the filtering type, although solid bowls are employed to some extent in batch machines for the separation of non-filterable materials, and to a large extent in continuous machines. Filtering type baskets are generally 40 to 48 in. in diameter or even larger. In horizontal-shaft type bulk machines, they have been built as large as 96 in.

Most batch machines use a basket spun on a vertical shaft, although in recent years there has been considerable interest in the horizontal-shaft bulk type for semi-continuous operation. Vertical shaft machines are of two basic types, the suspended, as illustrated in Fig. 7, and the center slung or link-suspended type, as shown in Fig. 8. Fig. 7 represents a conventional suspended perforate-basket centrifugal. Although the particular design is that of the American Tool & Machine Co., with minor variations it will serve to illustrate the great majority of centrifugals of the suspended type. Until a few years ago, machines of this type were commonly operated at speeds of about 1,200 r.p.m., but speeds have recently been materially increased and in special designs are now operated as high as 2,200 r.p.m. with a 40-in. basket. In the machine shown, the drawing omits the supporting structure which is attached to the cradling device shown below the motor. As drawn, the basket is actually two half sections, that on the left being a flat bottom basket which is the kind most commonly employed, while that on the right is a conical-bottom self-discharging type which operates satisfactorily only on materials which leave the basket readily at unloading speed. Since operating speeds have been increasing, most materials pack so tightly that the opportunities for self discharge are fewer than formerly. The flat bottom type requires the use of special plow-type discharging devices such as that shown in Fig. 12. Fig. 7 shows a commonly used method of driving the suspended basket, namely, through the use of direct connection to the motor. Less commonly, connection is through a centrifugal clutch. To provide for gyration of the basket, the spindle is supported flexibly. Should the basket become unbalanced through poor loading, the spindle and bearing assembly are permitted some sidewise movement so that the basket can rotate about its true center.

Another requirement of this type of centrifugal is an efficient brake to permit a short operating cycle. Sometimes it is necessary to water-cool the brake and a jet for this purpose is shown in the illustration.

The construction of the basket itself is also of interest. In the early days it was not uncommon for centrifugal force to tear a basket to pieces. Today, however, owing to improved construction and better construction materials, such explosions are practically unheard of. Modern baskets consist generally of a composite, including an outside envelope of perforated metal with rings of considerable width reinforcing the structure. Inside this is a cylinder of coarse wire mesh, to serve as a drainage area, while the inner filtering surface is made of fine wire screen or finely perforated metal, the apertures of which are small enough to retain the solids while permitting free passage of the liquid.

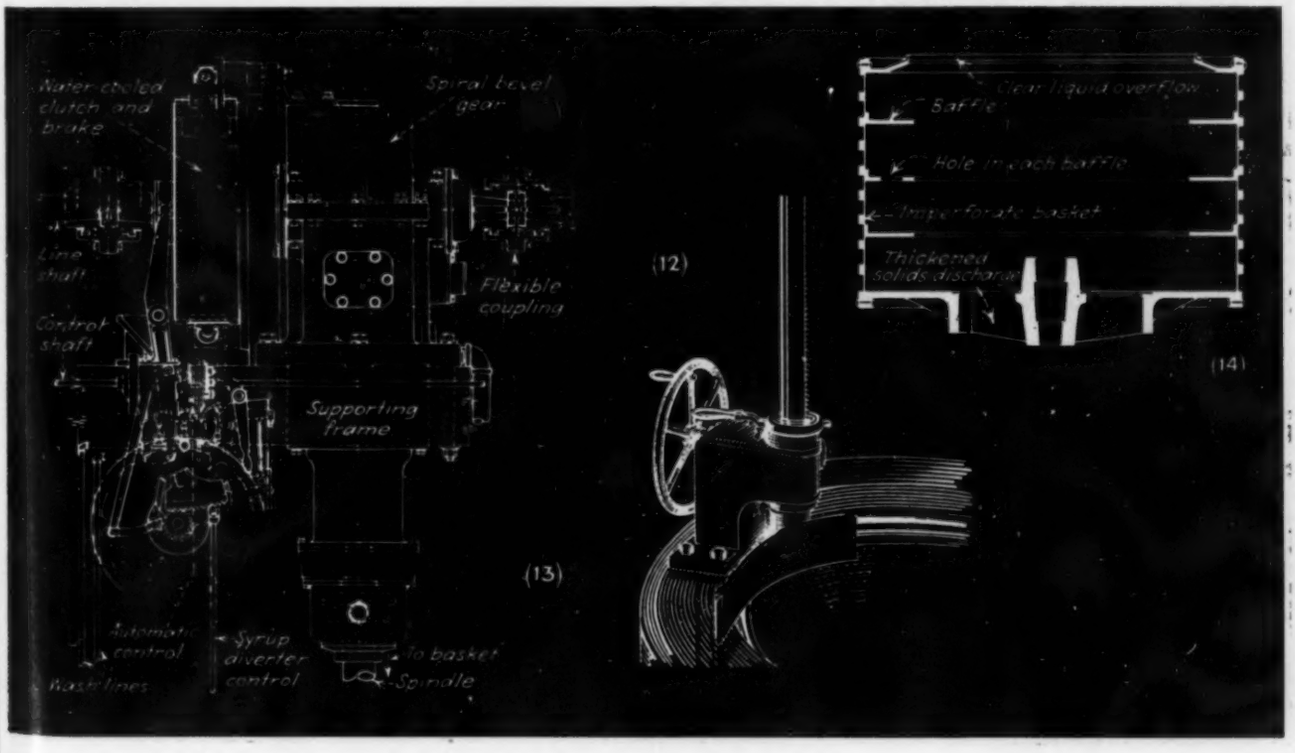
Considerably less versatile than the suspended centrifugal, although widely used in certain applications such as the laundry industry, is the link-suspended type which is generally under-driven. As will be evident from Fig. 8, the usual type of under-driven centrifugal can not readily be discharged from the bottom, hence, both loading and discharge are accomplished from the top. The machine needs little head-room and there is no central shaft to interfere with the loading of such materials as fabrics or rayon cakes. In some link-suspended machines the basket can be lifted out with a crane for loading. Another advantage of the link-suspended type is the ease with which it may be made vapor-tight for special applications.

As was previously mentioned, centrifugal clutches are sometimes employed in order to accelerate the heavy basket of a suspended centrifugal at the maximum permissible rate. Fig. 9 shows one such design, developed by the Tolhurst division of American Machine & Metals. This drawing also shows another method of mounting the brake drum and of supporting and giving flexibility to the shaft. In this design the motor drives a horizontal element containing pockets in which are a number of blocks of friction material, within a clutch drum attached to the basket shaft. In starting, the clutch permits the motor to accelerate almost to full speed before the load is applied. Such a clutch makes it possible to use a considerably smaller motor than usual, of better electrical characteristics. Power consumption is less in starting, and for unloading the use of a separate low-torque winding on the

Fig. 12—American Tool basket discharger

Fig. 13—Roberts geared drive

Fig. 14—Tolhurst solid basket



motor, in conjunction with the controlled slipping of the clutch that takes place at low speed, permits the operator readily to hold the desired low basket speed as long as necessary.

Another starting method, which is under development at present by Western States Machine Co., is the use of a hydraulic coupling between the motor and the basket spindle. This coupling is said to permit development of more uniform torque under varying load as compared with a direct-connected drive, and to permit the torque to be adjusted to suit the need. The motor runs always at top speed, but the coupling is operated to control the torque and hence the rate of basket acceleration, or the steady speed at which the basket is operated for loading, unloading, or spinning.

Several methods have been employed for providing the power for suspended centrifugals. One method commonly used is to employ a multi-speed motor having a low unloading speed and one or more higher speeds for loading and extraction. A very simple means of achieving a low unloading speed has been used by several manufacturers. Fig. 10 illustrates the design developed by American Tool & Machine Co. This method consists in the employment of two motors, a main motor for driving at high speed, and a small gear-head motor for driving at the desired low speed. Between the two is a free-wheeling clutch which disengages the small motor when the machine is operating at full speed but permits the small motor to engage and operate the basket at low speed when the main motor is de-energized. A second method of achieving low speed, developed by Fletcher Works, is shown in Fig. 11. This is a radially-mounted mercury switch which is driven in direct ratio to the speed of the motor and wired to the motor starter through a pair of slip rings. With the contact points toward the center of rotation, a rotational speed will be reached which will throw the mercury outward and break the contact, shutting off power to the motor. Then as the speed falls slightly, contact will again be made. Adjusting the angle of the switch gives any desired low speed which can be maintained with slight variation. Should several different low speeds be desired, an extra switch can be added for each speed.

SPECIAL CENTRIFUGALS

Numerous special centrifugal designs have been developed for special applications. For example, there is the gear-driven Roberts centrifugal shown in Fig. 13, a development of Western States Machine Co. This type of drive is employed at present only in the sugar industry, where centrifugals constitute very nearly the most important type of production equipment. Especially rapid acceleration and braking are necessary for efficient operation. The Roberts drive permits a gang of six machines to be driven in automatically controlled sequence from a lineshaft by a single large motor. As in Fig. 13, which shows the drive for a single centrifugal, each machine is connected to the shaft by means of a water-cooled friction clutch and driven through spiral bevel gearing. High speeds such as 1,800 to 2,200 r.p.m. can be achieved, with extremely rapid acceleration from loading speed. For rapid deceleration, the drive is equipped with a water-cooled brake operating on the exterior of the clutch drum.

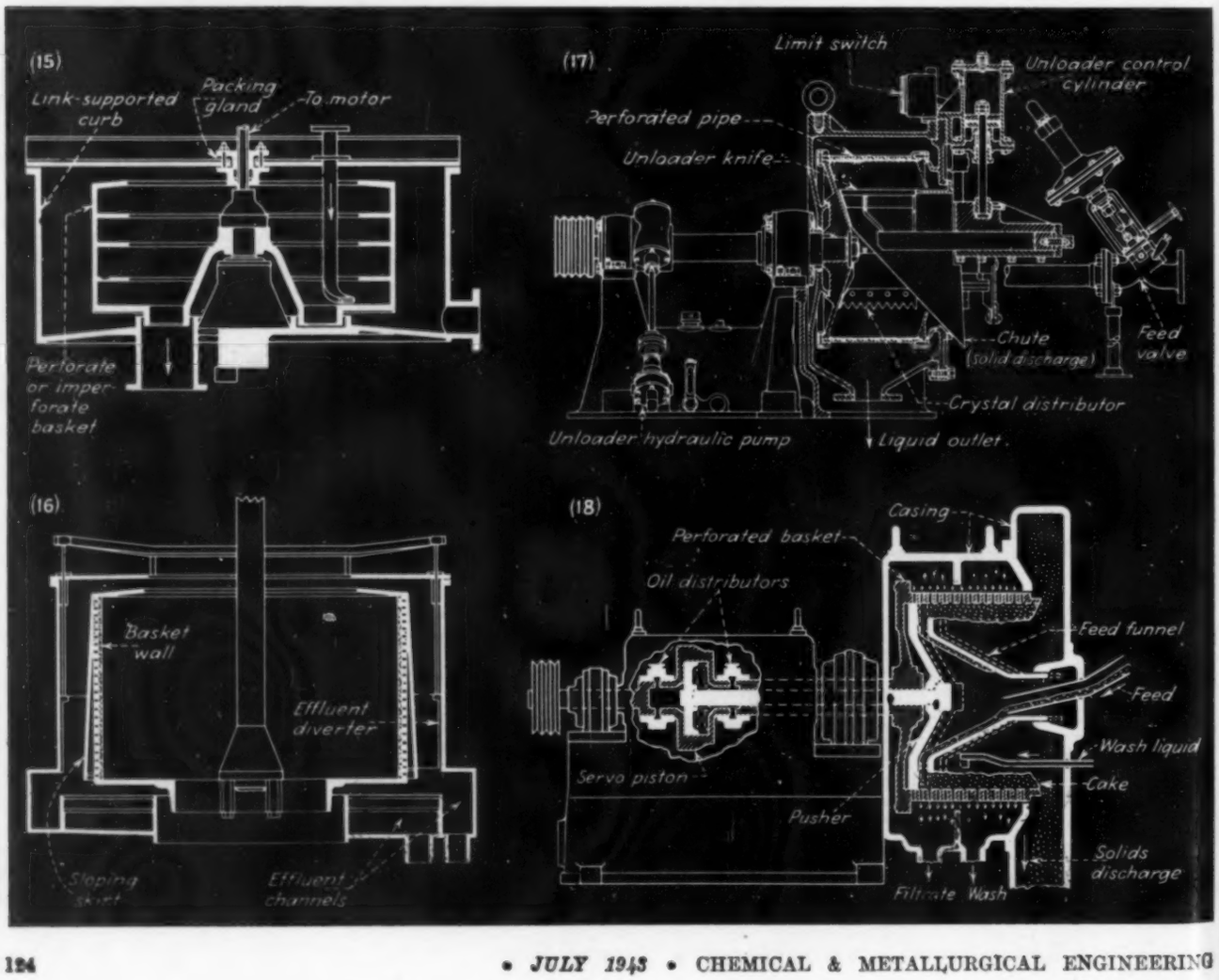
As another special application, this same concern developed a Pelton-wheel-driven centrifugal which has been employed to a considerable extent in Hawaii. Peculiarities of the Hawaiian sugar call for an extra high basket speed of 2,200 r.p.m. for a 40-in. basket. This machine is driven by a 14-in. Pelton wheel under water pressure supplied by

Fig. 15—American Tool link-suspended, bottom-discharge pressure-tight centrifugal

Fig. 16—American Tool basket for discharging viscous mother liquors

Fig. 17—Sharples automatic filter-type centrifugal

Fig. 18—Baker-Perkins ter Meer continuous centrifugal



pumps and is equipped with a brake above the wheel and a governor within the brake. Ability to reach full speed within 1½ minutes is claimed.

In addition to special types of drive, there are also many special types of basket developed generally for certain peculiar requirements, rather than for general use. For example, as previously mentioned, the imperforate bowl type of large-diameter centrifugal is one such special type. As shown in Fig. 14 (a Tolhurst design which, however, is similar to that made by other manufacturers), this type of bowl is employed largely for clarification operations where the solids are not free-filtering and are relatively small in amount. Pulpy and slimy solids are suitably separated from liquids by this means. Feed is introduced through a pipe near the bottom of the bowl and the liquid discharge is taken off at the top over a discharge lip. Interposed are a number of annular baffles, each of which contains one or more holes for the passage of the liquid. The baffles are necessary to prevent surging, but have no function in the actual separation process. For discharging, the bowl is stopped and the solids flushed from the bottom.

Two other special designs are illustrated in Figs. 15 and 16, both designs of American Tool & Machine Co. Fig. 15 portrays a type capable of bottom discharge, in addition to operation under pressure or vacuum. It is difficult to pack the shaft of a suspended centrifugal owing to the need for allowing freedom of gyration. On the other hand, a link-suspended centrifugal can readily be made tight, but is ordinarily underdriven and therefore is unhandy from the unloading standpoint. The new design shown in Fig. 15 gets around both difficulties by the use of link suspension and over-drive. This type is made in both filtering and solid-bowl modifications. In the former type, it can be provided with a plow discharger as in the case of ordinary suspended centrifugals. Such a machine has been employed in a combination reaction and extraction operation by placing the material to be treated in the basket, flooding it with a treating chemical under pressure, draining off the liquid, drying the cake by centrifuging and finally applying vacuum to flash off the remaining chemical.

Fig. 16 shows a special design of basket developed by the same concern, specifically for effecting a clean separation between a somewhat viscous mother liquor and the wash liquor employed after the initial extraction. With a viscous mother liquor, and an ordinary basket centrifugal, the mother liquor tends to cling to the curb and thus contaminate the wash liquor during the washing operation. Use of a sloping skirt applied directly to the basket, as in Fig. 16, causes substantially complete centrifugal ejection of the mother liquor from the lower edge of the skirt, permitting it to be directed by an effluent diverter into the proper effluent channel, after which the diverter is moved to the opposite extreme so that the wash liquor will be thrown into the second effluent channel.

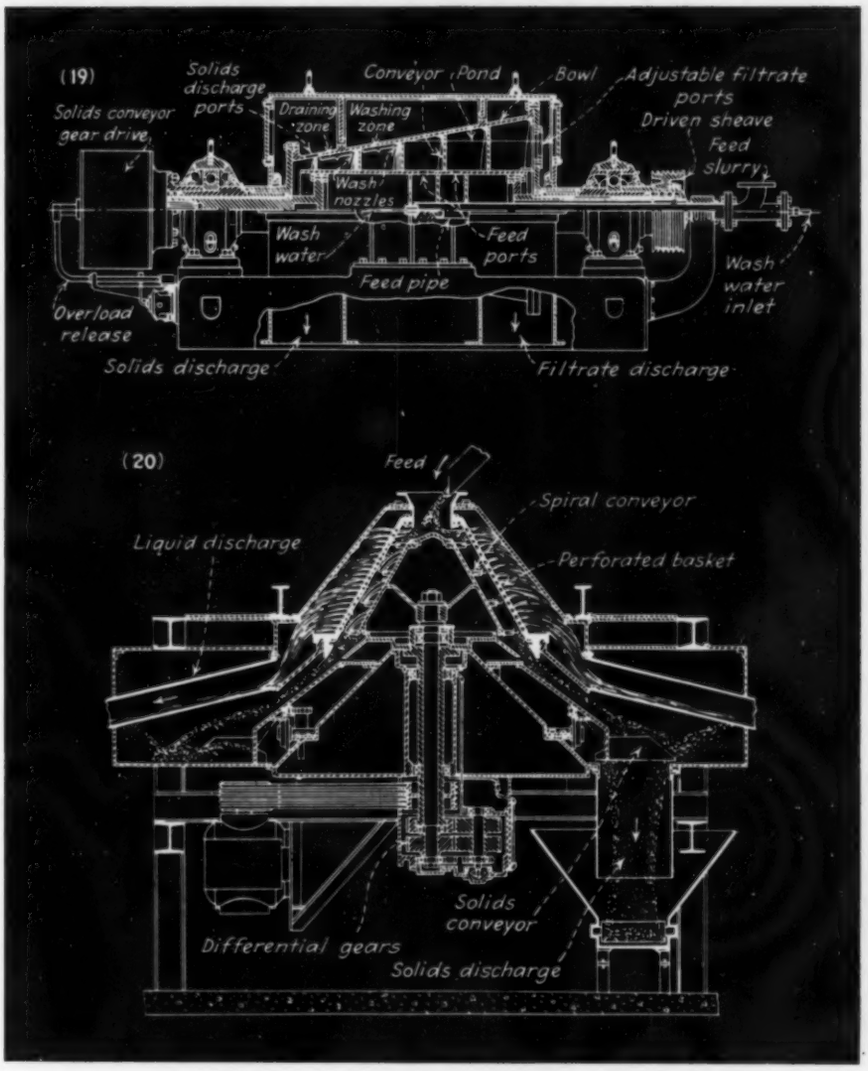


Fig. 19—Bird solid-bowl centrifugal "filter"

Fig. 20—Centrifugal & Mechanical Industries continuous centrifugal

AUTOMATIC BATCH CENTRIFUGALS

For the extraction of free-filtering materials on a large-tonnage basis, and also the large-scale clarification of liquids in settling-type centrifugals, recent years have seen the development of a number of automatic, cycle-controlled, horizontal-shaft centrifugals. Machines of this type usually consist of a large-diameter basket supported on an overhung horizontal shaft, with provision for feeding the slurry into the basket while it is operating at full speed. The material distributes itself over the basket surface and the liquid drains off into a casing. A cutter then cuts the cake from the filtering surface and drops it into a chute which removes it through the open end of the basket. Customarily, such machines are operated by electric or hydraulically operated devices controlled by a cycle controller. Since they are both loaded and unloaded at full basket speed, very little time is taken for these operations and the machines are therefore of much larger capacity than suspended centrifugals of the same diameter.

A small-diameter machine of this type is manufactured by the Sharples Corp. and is shown in Fig. 17. Built with 20-in. and 27-in. diameter baskets, it operates at high speed and is capable of extremely large capacity in relation to its size. For example, on free-draining crystals a capacity of 2 to 5 tons per hour is claimed, with as little as 2 percent moisture in the discharge. The machine has been employed largely on ammonium sulphate and on urea, but is also reported to be in use on such materials as nylon salt and hexamine crystals. No direct labor is required since operation is fully automatic. Washing is readily accomplished. Although the machine takes but a 50 lb. load, its total operating cycle is only 45 seconds in a typical case, which accounts for the large capacity.

Much larger diameter machines are made by Reineveld Centrifugal Co. and by Baker Perkins Co. The Reineveld machine, which is a Dutch development now built in the United States, features an outboard bearing support for the basket shaft which is at the center of

gravity of the basket and is therefore said to minimize vibration tendencies. The Baker Perkins ter Meer automatic is built with both perforate and imperforate baskets, for either filtration or clarification. For very large capacity, this Dutch-designed machine has been built with two baskets back to back. In the imperforate type, used for centrifugal sedimentation, the charge is delivered to the back of the drum to permit the maximum path of travel for the slurry through the clarifying zone. The solids are thrown out of suspension by centrifugal force and deposited as a cake on the drum wall while the clarified liquid flows over the drum flange at the front and passes out of the liquid discharge opening. The feed continues until the drum is nearly filled with solids when it is automatically shut off. Any liquor remaining on the face of the cake is removed by an automatic skimmer and immediately thereafter the cake is peeled off by an automatic unloader. Automatic machines are frequently used for ammonium sulphate. They have also been employed for separating calcium sulphate in phosphoric acid manufacture, and in the recovery of starch.

CONTINUOUS CENTRIFUGALS

Fig. 18 shows a second type of ter Meer centrifugal manufactured by Baker Perkins Co. which is continuous in operation. This type always employs a perforate basket and is used for relatively coarse crystals containing not more than 10 percent of —100 mesh material. It requires a mother liquor of relatively low viscosity. It is built in sizes from 24 to 48 in. Referring to the drawing, feed enters the horizontally supported basket through a feed funnel which is mounted on the pusher shown, and rotates with the basket. Flowing outward between the funnel and the pusher under the action of centrifugal force, the solids deposit on the perforate wall of the basket while the liquid drains through and is thrown into the casing. Meanwhile, the pusher reciprocates within the basket through a small stroke, driven by a hydraulic piston contained within a cylinder formed in an enlargement of the basket shaft. A pump and automatically cycled valve system apply oil pressure first to one side of the piston and then to the other. Hence, as crystals build up on the basket surface, they form a wall of dried material of uniform thickness which moves gradually over the basket surface and discharges from the open end. Before discharge, the crystals may be washed with one or more wash liquors which can be readily kept separate from the mother liquor and from each other by suitable baffling of the casing.

Most attempts at the development of continuous centrifugals have been in the direction of the employment of a spiral scraper conveyor within the centrifugal bowl or basket, for the continuous removal of the solid material. An outstanding example of this design is the machine built by Bird Machine Co., one type of which appears in Fig. 19. This manufacturer produces continuous centrifugals with both perforate and imperforate baskets but reports that the advantages of the solid-bowl type so outweigh those of the perforate type for most purposes that the majority of machines produced in recent years have been of the solid type. The solid-bowl type is said to be capable of accomplishing the same separations, almost without exception, as the perforate type, yet this machine is simpler to build and consequently less costly. Fig. 19 shows the solid-bowl type of Bird centrifugal "filter" which is actually a continuous sedimenting and draining machine but is capable of delivering solids equally as dry as the true filtering type. By a slight modification, this machine can also be used as a centrifugal classifer to separate solids either according to particle size or specific gravity. The principal modification consists in carrying a greater pond depth in the bowl and in operating at such a rate that the fines overflow at the liquid discharge end, while the oversize discharges from the solids discharge ports.

Referring to Fig. 19, the machine consists of a conical solid bowl mounted on a horizontal shaft, within which is a cylindrical drum carrying on its surface a spiral conveyor. The feed and wash liquid pipes pass through the hollow righthand shaft while the lefthand shaft, which is also hollow, connects with the conveyor drive gears which communicate motion back to the conveyor through the quill shaft passing through the center of the main shaft. The conveyor gear ratio is designed to give a slight differential in speed between the solid bowl and the spiral conveyor so as to move deposited solids toward the left or small-diameter end of the bowl. Feed enters through the feed pipe, passing through holes in the conveyor drum and moving outward under centrifugal force to the bowl. Deposited solids are moved to the left, while the separated liquid flows out over an adjustable dam at the right. When it is desired to wash the solids, this is accomplished by the admission of wash liquid through the wash water pipe which communicates with the wash nozzles shown attached to the conveyor drum. The solids are then allowed to drain before discharging.

A great many uses are now being made of the centrifugal filter and classifier. The classifier is stated to permit separations at around 1 to 2 microns, as compared with 10 microns for a hydroclassifier. It is being used on closed circuit wet grinding in one large cement plant where it is classifying at ball mill consistency without the necessity for dilution. Classifiers are also being used to a considerable extent in conjunction with flotation, both in metallurgy and in cement manufacture. An advantage in favor of the method is the fact that the point of cut can be changed very readily. In use in conjunction with ore flotation, this equipment is said to decrease reagent costs as much as one-third by the separation of slimes prior to flotation.

Among some of the other newer applications, particularly for the centrifugal filter, may be mentioned its use in the preparation of a large proportion of all high-grade coating clays now made in the United States; in the separation of fine salt from 50 percent caustic in many new electrolytic chlorine plants; in the separation of blanc fixe to close specifications directly following the precipitation tank; and in the preparation of a large number of other chemicals. One new use for the machine, when operated as a classifier, is in the production of finely ground white marble classified at 5 to 10 microns for use as a paint extender and in synthetic rubber. Among numerous uses for the solid bowl filtering type may be mentioned the production of alumina from calunite; ammonia alum; ammonium nitrate; aniline oil; barium carbonate and sulphate; many plastics; Thiokol; bentonite gels; pyrites; arsenates; chromates; cryolite; phosphoric acid and phosphates; milk of lime; potash; fluorspar; hexamine; pigment oxides; lead salts; white lead; lithopone; potato starch; nylon salt; cream of tartar; titanium pigments; potassium perchlorate; reclaimed rubber; anhydrous sodium sulphate; Glauber's salt; zinc oxide; and many other materials.

With further reference to the Bird centrifugal, it should be noted that the screen type is intended primarily for use on coarse solids; where extra thorough washing is necessary; and where the wash water and filtrate must be kept separate. The solid-bowl machine is used as a filter when the filtrate must be essentially free of solids; and as a classifier when a very close cut between particle sizes is necessary.

Still another type of continuous centrifugal, which is built only in the screen type, is shown in Fig. 20. This machine, made by Centrifugal & Mechanical Industries, is a development of the Elmore centrifugal which was on the market several years ago. It is employed in the dewatering of granular materials larger than 80 mesh and is being used primarily on coal, sand and ores. Its construction is evident from the drawing. Feed is introduced at the top of the rotating conical conveyor drum on to a feed plate which throws it on to the surface of the rotating perforated basket. The conveyor drum and conveyor rotate at a slight differential speed with respect to the basket, moving the deposited solids downward toward the discharge. Liquid is thrown outward into the casing surrounding the centrifugal. In the design shown, the solids discharge casing is equipped with a rotary scraper conveyor which scrapes the solids to the discharge point for delivery to a belt conveyor.

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PROCESS EQUIPMENT NEWS

Gage Protector

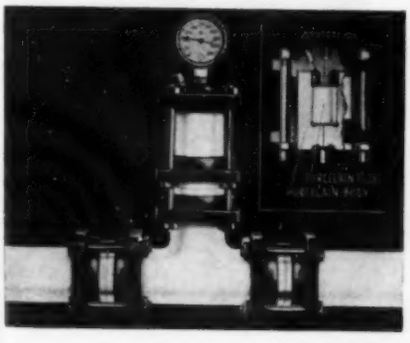
PROTECTION of direct-acting pressure gages located in systems handling corrosive liquids is the function of a new snubbergage protector manufactured in chemical porcelain by the Lapp Insulator Co., LeRoy, N. Y. The construction, which is shown in an accompanying illustration, includes a porcelain body within which is a precision-fitted porcelain float. The cavity between the float and the gage is filled with a neutral oil. Pressure from the line or vessel below is transmitted through the float to the oil above. Danger of seepage past the float is said to be minimized by the smooth, tight fit and by the fact that pressures are equal above and below the float. The protector is designed to fit this company's porcelain pipe of 1 in. inside diameter.

Automatic Flow Controller

AN ENTIRELY NEW automatic controller for use with its Rotameter flow meters has been introduced under the name of Rotamatic by Fischer & Porter Co., Hatboro, Pa. Connection between the Rotameter indicator and the control instrument is electrical, employing a balanced induction bridge for which several new features resulting in increased sensitivity are claimed. For example, as will be evident from the accompanying illustration, the balance beam of the receiving bridge is equipped with curved segmental end pieces to assure linear motion of the armatures. The coils are wound on precision-bore glass tubes, thus decreasing armature friction and permitting use of smaller bore tubes, thus increasing the strength of the coils. Furthermore, separation of the two induction balance coils has permitted use of a greater effective travel of the armatures than is customary.

The control unit proper makes use of a new type of non-bleeding, diaphragm-operated relay pilot valve which builds up the desired controlled output air pressure under influence of a nozzle leak and flapper. The flapper in turn is positioned by the instantaneous value of the controlled flow rate, that is, by the position of the induction balance beam. Proportional control is achieved, together with automatic reset, through the action of an opposed pair of bellows, one for throttling, one for reset, which together serve as a follow-up in attaining the final position of the flapper, and hence the final control pressure, after any change in the controlled quantity. A novel means of varying the throttling range is employed, consisting in tipping the entire bellows assembly, so as to vary the bellows effect on the flapper. The reset factor is also fully adjustable.

Chemical porcelain gage protector

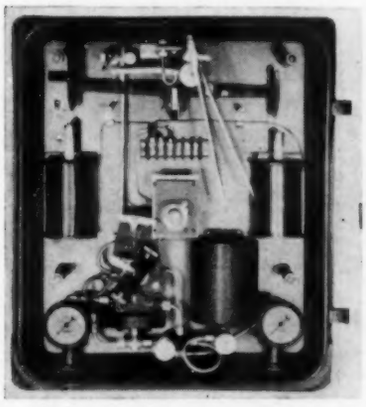


Vertical hollow-shaft explosion-proof motor

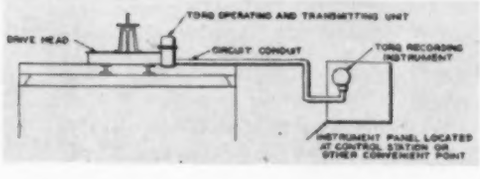
Explosion-Proof Motors

A NEW LINE of vertical, hollow-shaft, explosion-proof motors is now being offered by Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill., for operation in Class I, Group D hazardous gas locations. These motors, designed primarily for pumps handling large quantities of volatile hydrocarbon liquids are claimed to minimize the hazards arising in pumping applications of this type.

New Rotamatic flow controller



Thickener performance recorder


TORQ OPERATING AND TRANSMITTING UNIT
DRIVE HEAD
CIRCUIT CONDUIT
TORQ RECORDING INSTRUMENT
INSTRUMENT PANEL LOCATED AT CONTROL STATION OR OTHER CONVENIENT POINT

Thickener Performance Recorder

TO PROVIDE an accurate continuous record of thickener operation, the Dorr Co., 570 Lexington Ave., New York, N. Y., has developed a device known as the Dorr Torq Recorder. The instrument, designed for use on this company's type A thickeners equipped with standard overload alarms, is particularly applicable where appreciable fluctuations in the load on the drive unit are caused by variations in solids accumulation in the thickener. The recorder consists of two electrically connected control parts, the transmitting unit and the recording unit. The former is built into the standard overload alarm on the drive head, while the recording unit may be located at the control station or any convenient point offering easy access to the operator. Not only does the new device produce a permanent record of load conditions within the thickener, but it also facilitates control by the operator since it indicates any gradual accumulation of solids and insures against troublesome overloads or temporary shutdowns. Its use is also said to permit obtaining maximum underflow density through regulation of the speed or stroke of the pump, without danger of serious overloads.

Glass Tank

TANKS constructed entirely of glass, made by building up the required shape and size of heavy tempered glass plates, have been announced by the Pittsburgh Plate Glass Co., Grant Building, Pittsburgh, Pa. The resulting structure is said to be rigid, permanent and free from maintenance or wear. A new method of heat treating of the tank material is said to give it a physical strength four to five times greater than ordinary glass. The glass is claimed to have a high resistance to thermal shock and to withstand continuous operating temperatures of 650 deg. F. and an instantaneous thermal shock of 400-500 deg.

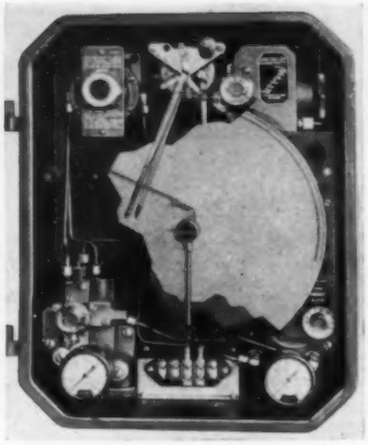
The problem of joining the sheets is said to have been solved through the use of sheets of comparatively large size with accurately ground joints and the use of a special jointing material developed for this purpose. The entire tank is usually surrounded by a wooden

framework filled with a compound to insure against leaks and to protect against severe physical blows. Such tanks have already been employed in severe service applications such as metal pickling, as well as in rubber, synthetic rubber, textile, paper, electroplating and other applications. Both flat and semi-cylindrical-bottomed tanks have been produced.

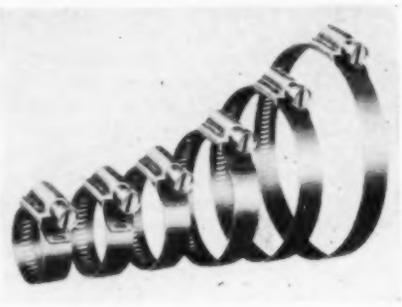
Alloy Spray Gun

A NEW PROCESS for the application of protective metal coatings to metal assemblies or structures, and for re-coating areas burned by welding, as well as for patching or repairing small areas in large galvanized assemblies, is available from the Alloy-Sprayer Co., 2040 Book Bldg., Detroit, Mich. It is claimed that by means of the new process, actual tinning of the sprayed metal with the base metal is accomplished so that under certain conditions, sandblasting or other extensive preparation of the base metal surface is unnecessary. The operation consists in spraying the surface to be protected with a coating of Galv-Weld metal by means of this company's gun which is a portable self-contained unit having a thermostatically controlled metal melting pot and a means of atomizing and spraying the melted metal under air pressure. If the work is not already hot, before spraying it must be reheated to from 250 to 475 deg. F. and then sprayed. The alloy used, Galv-Weld, is an alloy high in lead and thus is relatively non-critical. It melts and is sprayed at about 500 deg. F.

Application of Galv-Weld metal by alloy-sprayer

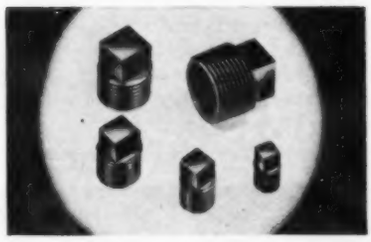


Improved manual-automatic control



Improved hose clamp

New boiler water test unit



Plastic pipe seal plugs

Improved Hose Clamp

A NOVEL DESIGN of hose clamp, which although developed primarily to meet Air Corps specifications, seems to have interesting possibilities for process industries applications, has been announced by the Aircraft Standard Parts Co., 1711 19th Ave., Rockford, Ill. The new Aero-Seal hose clamp is made in 14 sizes from ¾ in. to 4 in. inside hose diameter. The clamp consists of a tempered steel band punched with holes corresponding to the teeth of a worm gear. These holes mesh with a worm in the housing welded to the fixed end of the band. The worm is turned by a screw driver and the screw head on the worm is fitted with a safety cup which prevents the screw driver from slipping and puncturing the hose or damaging other equipment. Rapid action is obtained by a 10-pitch thread so that full take-up is attained with only a few turns.

Boiler Water Tester

SERIES F is the designation of a new line of boiler water testing outfits recently introduced by the American Colloid Division of E. F. Drew & Co., 15 East 26th St., New York, N. Y. The equipment has been designed for use in conjunction with the chemicals produced by the parent company for control of boiler feedwater conditions. This unit permits a rather extensive analysis of boiler water including such factors as alkalinity, hardness, phosphates, chlorides, pH value and excess sodium sulphite. The company is also prepared to supply even more complete units permitting analyses also for dissolved oxygen, iron, sulphate, silica and turbidity. Electric-eye measurements for exceptional accuracy and speed are available in some of the more advanced models.

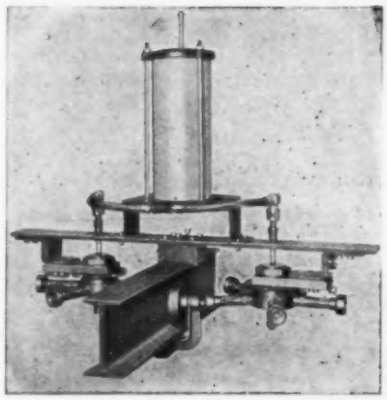
Instrument Improvements

TWO IMPROVED ACCESSORIES for automatic process control has been announced by Taylor Instrument Cos., Rochester, N. Y. One is a booster relay air valve which when installed in the air line adjacent to a diaphragm motor valve greatly accelerates the action of the latter. The booster uses an independent air supply of 25 to 150 lb. pressure to operate the control valve, being itself controlled by the air supply from the instrument. When large diaphragm motors are to be operated, or when the air lines from the instrument are long, there is likely to be considerable delay in valve action. With the company's largest valve motor, having a diaphragm of 144 sq.in., the action is said to be five to seven times faster through the use of the new booster than when the valve is operated direct from the controlled air supply. The new device introduces no change in the control pressure, having a ratio of one with respect to the controller output, but simply allows the new pressure to be built up much more rapidly.

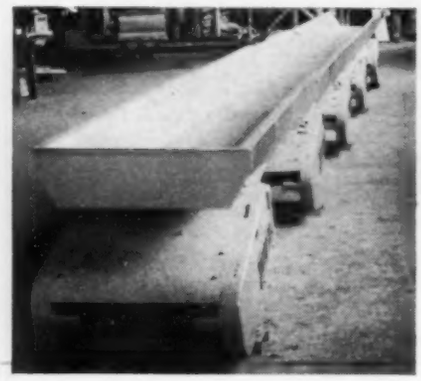
A second new Taylor development is an automatic-manual attachment for process controllers which is shown in an accompanying illustration. When the new unit is in "manual" position, controlling air pressures are applied both to the control valve under regulation of the unit, and to the idle controller so that control can be changed instantly from manual to automatic without process disturbances. In addition to the usual three positions of "automatic", "manual", and "service", this new unit contains a fourth step, "test." In this position the control is manual but the full air line pressure is applied to the instrument mechanism to permit its complete and accurate adjustment without disturbing the position of the controlled diaphragm valve.

Plastic Pipe Plugs

PRIMARILY for the protection of threads of equipment and pipe fittings in storage or in transit, is the line of plastic pipe seal plugs recently introduced by American Molded Products Co., 1644 North Honore St., Chicago, Ill. These plugs are light, tough, durable



Conveyor trolley wheel lubricator



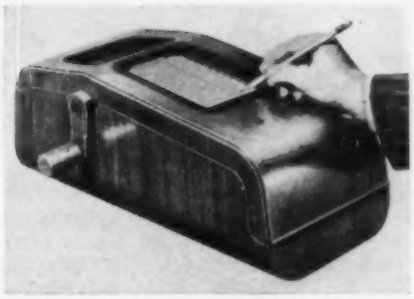
Pulsating magnet vibratory conveyor

New percentage timer

and non-corrosive, according to the manufacturer, and are capable of replacing critical materials heretofore used for the protection of threads against damage, moisture, dirt, weathering, rust and corrosion. They are available in five sizes ranging from ⅜ to 1 in. i.p.s.

Conveyor Lubricator

DESIGNED especially for lubricating the bearings of conveyor trolley wheels in conveyor kilns, dryers and other similar heated equipment, is a new lubrication device which has been developed by J. N. Fauver Co., Detroit, Mich. The lubricator is mounted on the trolley rail so as to serve simultaneously the bearings of each pair of wheels, every time they pass the point of installation. The device requires no independent power but is driven by the travel of the conveyor itself, starting and stopping with the motion of the conveyor chain. As the trolley wheel approaches the lubricator, the hub engages a sleeve of one of the five pumping units which is thus automatically brought into contact with the wheel bearing. Continued rotation of the lubricator forces the pumping unit inward, delivering a measured quantity of lubricant through the fitting to the wheel bearing. Grease reservoirs of 5 or 12 lb. capacity are standard equipment.



Register of non-strategic materials

Alloy steel pressure containers

Pulsating Magnet Conveyor

TO PERMIT the use of vibratory conveyor equipment in long lengths, the Syntron Co., 610 Lexington Ave., Homer City, Pa., has developed an electrically vibrated conveyor in which the conveying action is accomplished by high speed vibrations set up by multiple pulsating driving magnets. There are no moving parts. Control of the rate of flow of material through the conveyor is by rheostat from either a nearby or remote point, by which automatic control is possible. Trough styles can be supplied in either flat pan or sealed tubular sections, with or without multiple intake openings and multiple discharge gates. Depending on the details of a particular application, the driving magnets can be either below or above the trough, either floor mounted or cable suspended. The accompanying illustration shows a 35 ft. section of a 130-ft. long flat pan type conveyor for the handling of extremely hot material.

Percentage Timer

TO PERMIT controlling automatically the percentage of time during which an a.c. circuit can be closed or opened within a definite length of time cycle, the R. W. Cramer Co., Centerbrook, Conn., has developed a new percentage timer employing a self-starting synchronous motor driving a cam-operated switch mechanism through an inclosed gear train. The percentage of operating time is a function of the motor-driven cam in relation to a similar stationary cam fixed to a calibrated dial. Varying the position of the stationary cam alters the relation between parts of the contact mechanism and opens and closes the switch a definite percentage of the total cycle as indicated on the dial.

The new timer is said to be suitable for controlling the input of electric heat to equipment, or controlling the proportionate flow of chemicals. It is available in seven different time ranges from 30 seconds to 60 minutes total cycle.

Cabinet Register

MADE ALMOST ENTIRELY without metal is the new standard cabinet model register made by the Standard Register Co., Dayton, Ohio. Said to be the first business machine made of non-strategic materials, the new register is useful in the keeping of plant records and in the operation of wartime visitor control systems. The machine is made of laminated plywood with hardwood working parts, weighing about 8 lb. instead of the 15 lb. or so for a steel register.

Alloy Steel Cylinders

STEEL CONTAINERS for high-pressure gases and liquids, designed and produced by Walter Kidde & Co., Bellville, N. J., are now available for general use on lower priorities than formerly. Made of alloy steel, cylindrical in shape with round bottoms, necked and threaded to specifications, they are made in accordance with I.C.C. regulations. New drawing methods and metallurgical treatments are said to give strength designed for working pressures up to 1800 lb. per sq.in. combined with unusually light weight. Weights of empty containers range from 1½ lb. for the 20-cu.in. size up to 21 lb. for the 646-cu.in. size. The cylinders are stated to crush without shattering and to be available in special non-fragmenting forms. Cylinders are produced by drawing in successive steps from steel disks. They are surface treated and stress-relieved, as well as rigidly inspected for strength, size and other factors.

Electronic Level Control

TWO NEW electronic level controls designed respectively for high- and for low-level control have been announced by Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass. Each type is furnished as a complete unit in a vapor-proof cast-iron housing for direct tank installation. The equipment is intended for conductive liquids of an explosive nature. The housing may be screwed into a 1-in. flange on top of the tank. From the unit, a probe rod projects through a nipple into the tank to the desired

length. Probes of brass are standard, but other metals are available on demand. High-level control is accomplished when liquid rises and contacts the probe tip. Low-level controls similarly operate when the liquid drops below the probe tip. Both models incorporate a safety feature providing for operation of the relay in case of current or tube failure. In both types the relay connections are of the single-pole, double-throw switch type. Contacts are rated for 1,000 watts a.c. The units function with any conductive liquid or may be employed for detecting the presence of water or acids in tanks of non-conductive liquids.

Interchangeable-Frame Motor

AFTER 2½ years of development, Robbins & Myers, Springfield, Ohio, has announced its new line of Uni-Shell electric motors, said to be the only complete line in which all motor types in any one frame size are interchangeable. These motors are built within cylindrical shells of steel. In any one frame size, the shell dimensions, head fit, shaft size and other characteristics are identical for all motor types. This gives the important advantage that when a non-standard motor is required on a standard piece of equipment, the desired type of motor can immediately be fitted. Similarly, in plants where motors are used to drive equipment, make-shift adaptations are unnecessary when other types of motors of the same frame size can be employed.

In ball-bearing motors all types use double-row ball bearings with exceptionally large grease reservoirs. Sleeve bearing motors have been similarly improved. Special new synthetic varnish treatments have been used for extra insulating effect. As an example of the adaptability of the new line it may be mentioned that the four motors shown in the accompanying illustration differ to the eye only in the end heads. Motor (1) is a polyphase induction motor, made in sizes from 1 to 30 hp. Motor (2) is a capacitor-start, single-phase induction motor in sizes from 1 to 5 hp. Motor (3) is a standard d.c. motor and generator, in sizes from 1 to 7½ hp. Motor (4) is a repulsion-induction motor made in sizes from 1 to 5 hp. Not illustrated are drip-proof and splash-proof motors which have covers added or special heads.

Wire-Reinforced V-Belt

DESIGNED for the most rigorous services, a wire-reinforced V-belt is now being produced by the B. F. Goodrich Co., Akron, Ohio, which first built belts of this type in 1938. Two types are now available, a cable cord construction, and a grommet construction which incorporates a wire cord placed in the center of a cotton or rayon grommet. Such belts are claimed to make possible greater horsepower capacity, together with increased tensile strength and low stretch. The manufacturer points out, however, that especial care is necessary in studying the details of an application before it is possible to decide whether a belt of this type is practical.

Electrode Holder

FOR HEAVY electric welding jobs, Jackson Products, Detroit, Mich., has developed an air-cooled electrode holder which dissipates the intense heat produced by heavy electrodes, thus improving the efficiency of the operator. Air from the plant air line, at a pressure of 3 to 4 lb., passes through the entire length of the lower tong.

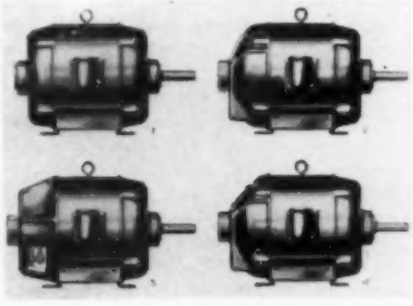
High Capacity Turbine Pump

DESIGNED primarily for pumping water from flowing streams or lakes for war plants, but also suitable for use in large diameter wells for industrial and other water supplies, is a new line of high capacity vertical turbine pumps recently announced by Layne & Bowler, Memphis, Tenn. The company has recently fabricated five complete pumping units for a synthetic rubber plant, the units being equipped with two-stage, 30-in. bowls designed to deliver 11,000 g.p.m. against a total dynamic head of 169 ft. The pumps are driven by 500-hp. vertical, hollow-shaft motors and will pump water from a flowing stream. Another synthetic rubber plant is employing 15 complete pumps with 36-in. diameter single-stage bowls, with a capacity range from 11,000 to 14,000 g.p.m., also powered by 500-hp. motors. Capacities for the new line range upward to 16,000 g.p.m. Unusually high efficiencies are stated to be obtained throughout a wide capacity range, owing to the fact that the bowls are of a true turbine type. These features are said to make the new pumps particularly suitable for pumping from rivers or streams.

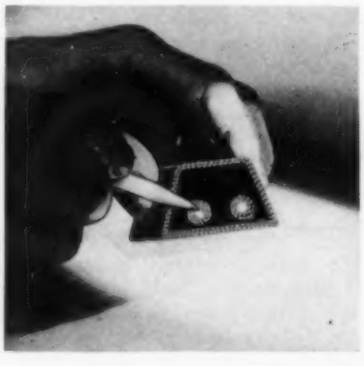
Industrial Chilling Unit

TWO NEW MODELS of its Deepfreeze industrial chilling machine have recently been announced by the Deepfreeze Division of Motor Products Corp., North Chicago, Ill. Model D-70 is a two-stage unit having a maximum capacity of –70 deg. F., and capable of removing 800 B.t.u. per hour at that temperature. The other is a –120-deg. chilling machine employing the "cascade" principle of two-stage refrigeration and capable of removing 1,000 B.t.u. per hour at the low temperature of operation. The D-70 model employs two compressors with refrigerated heads, a temperature control which is adjustable from atmospheric temperature to –70 deg., and a specially designed expansion valve which is electrically controlled, together with a dehydrator charged with silica gel. The unit employs two-stage compression and a single-stage refrigeration principle. Its chilling chamber has an interior diameter of 18 in. and a depth of 30 in., and is provided with heavy insulation. The –120-deg. cascade machine employs two-stage refrigeration instead of two-stage compression, the first compressor acting to extract heat from the barrel and introduce it to a heat exchanger, the second compressor in turn extracting heat from the heat exchanger and dissipating it to the air. A third compressor is provided to cool the heads of the working compressors.

Four types of Uni-Shell motors

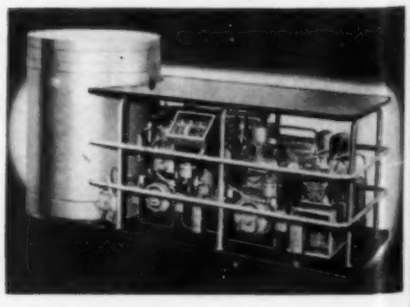


New wire-reinforced V-belt



Two-stage high capacity pump

—120-deg. F. cascade chilling unit



"I HAVE THE GOOD OLD *Let's Go* SPIRIT TOO!"

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000

"I am the CASH STANDARD Streamlined Type 1000 PRESSURE REDUCING VALVE — streamlined for uninterrupted maintenance-saving performance — for smooth, even flow of steam, water, air, oil, etc. I am imbued with the will to go along with the top notch operation that plants aim for. There are no weak spots in my make-up — nothing that will cause you to frown on me or for that matter, to give me any particular attention once I am in your service. Cooperation with my boss and all the other equipment is my life's work — no loafing on the job whether it's one shift a day or three. I am all out to give all — all the time. It's the will to win in good times or bad — under ordinary or tough conditions that gets things done and I am all for it — so, let's go!"

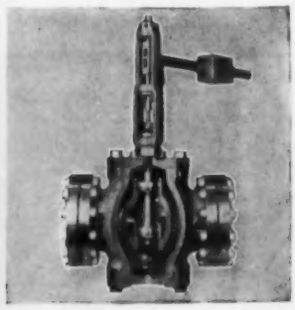
You Get All This

- Trouble-free service
- Smooth operation
- Tight closure
- Accurate regulation
- Elimination of failures
- Constant delivery pressure
- No spoilage
- Practically zero in maintenance costs
- Speedier production results
- Cost saving operation

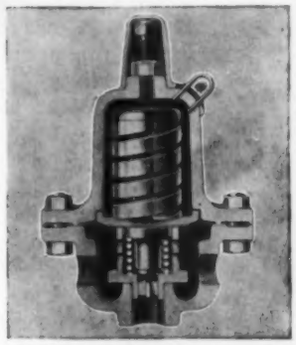
CASH STANDARD CONTROLS .. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

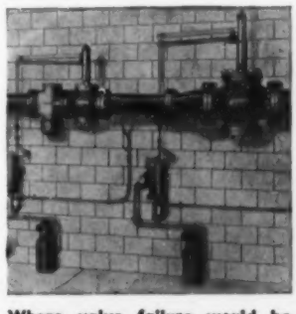
OTHER VALVES *from the* CASH STANDARD LINE



For precision jobs — the CASH STANDARD "42-R" Balanced Lever Valve. No lost motion; practically no maintenance. Heavy renewable seat rings; valve stem integral with inner valve. Roller guides kill side strains and stop packing trouble. Sizes ½" to 12"; pressures up to 600 lbs. Highest temperature 800 deg. F. In iron, bronze, and steel bodies; all standard trims. This valve is made also with center guide, and with Water Cooled, or Air Cooled Packing Box.



Cash Standard Type Q Relief Valve; maintains constant upstream pressure by relieving into lower downstream pressures, regardless of variations in downstream pressure. For steam, water, air, oil, many gases. Iron or bronze bodies; bronze trim; pressures up to 350 lbs.; top temperature 500° F. Screwed ends; sizes ¼" to 2".



Where valve failure would be costly, here are two "42-R" valves operated by CASH STANDARD Type 100 Automatic Controllers, in two-stage pressure reduction. First stage: a 5" Valve reducing 150 to 50 lbs. gauge; second stage: an 8" Valve reducing 50 to 5 lbs. gauge. Load 70,000 lbs. steam per hour. Nearly four years' daily use; not a moment's trouble.

Butyl Rubber Production at Baton Rouge

BUTYL RUBBER was developed by the Standard Oil Co. (N. J.) in 1937 and improved by continuous research since that time. The unit that is now in operation at the Baton Rouge refinery of the subsidiary organization Standard Oil Co. of Louisiana combines isobutylene produced at the refinery with a small amount of isoprene to form the synthetic rubber. These raw materials together with the diluent are mixed in a large tank from which the mixture is fed continuously to the reactor. Before entering the reactor the feed is cooled to −150 deg. F. using ammonia and ethylene for refrigeration. A catalyst is introduced continuously into the bottom of the reactor together with the feed stock to start polymerization. The construction of the reactor permits the maintenance of a temperature of −150 deg. F. It is a vessel 4 ft. in diameter and 15 ft. in height with provision made for vigorous agitation. It has a specially designed head which may be easily and quickly removed in case the reactor becomes plugged due to formation of heavy polymer slurry. The products from the reaction, which include butyl rubber polymer, unreacted isobutylene and the diluent, flow into a flash drum maintained at +150 deg. F. This temperature is sufficient to vaporize the unreacted isobutylene, the diluent and also to destroy any catalyst that may remain. The polymer forms a water slurry in the bottom of the flash drum and after passing through a stripper operated under vacuum to remove the last traces of the diluent, passes to the finishing building. Here a large portion of the water is separated by a vibrating screen and the remainder is removed by one pass through a tunnel dryer at 150 to 220 deg. F. Material leaving the dryer is either extruded or milled. In the case of the material that is extruded, it passes along a short conveyor to the point where it is cut into slabs and packed for shipment. That portion of the material passed over the rollers of the mill is cut into the form of a ribbon and cooled on a long conveyor over which cool air flows. The cooled ribbon is then cut into slabs for shipment. The unreacted isobutylene and diluent leaving the reactor are vaporized in a flash drum compressed to 30 lb. pressure, dried by passing through alumina dryers, further compressed to 200 lb. pressure and delivered to a series of fractionating towers for separation of the individual constituents. Some of these constituents are recycled back to the reactor feed drum and others are discarded from the system to prevent accumulations of poisons in the polymerization section.

CHEMICAL & METALLURGICAL ENGINEERING

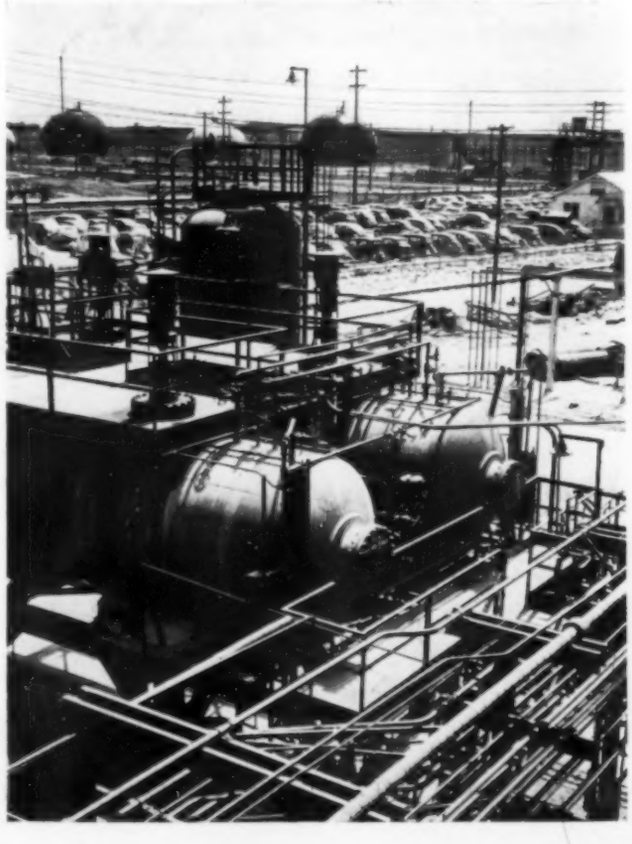
July, 1943

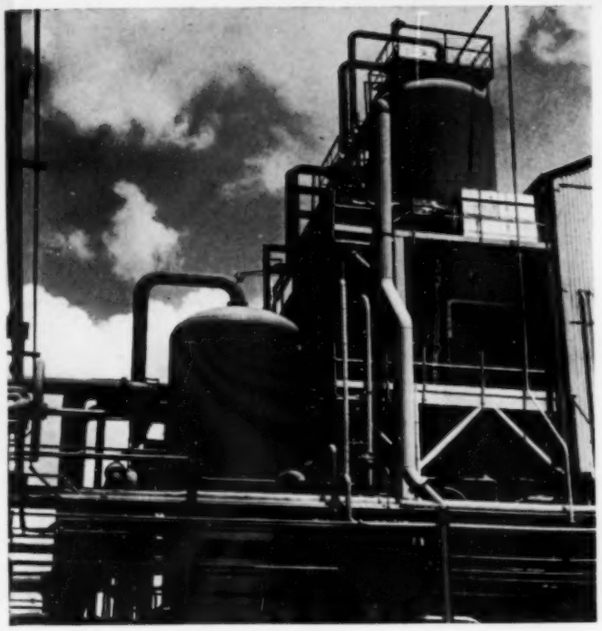
PAGES 132 to 135

1 Raw materials can be piped from nearby refinery units to storage in Hortonspheres located near processing building

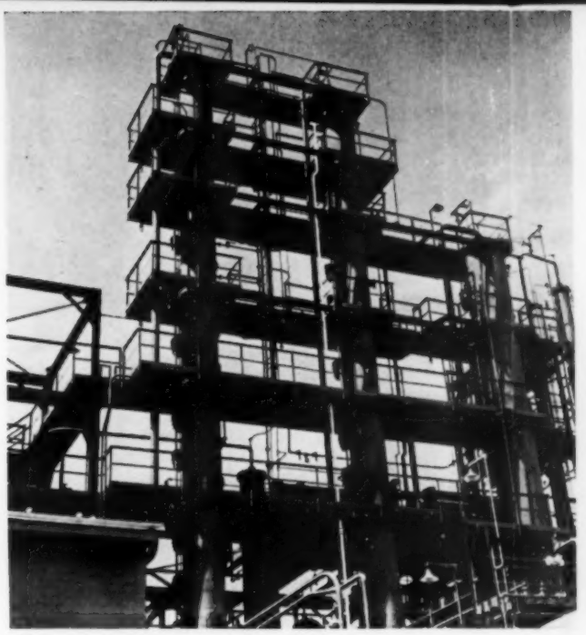
A *Chem & Met* FLOW SHEET

2 In these horizontal tanks the raw materials are mixed and stored until fed to the reactors



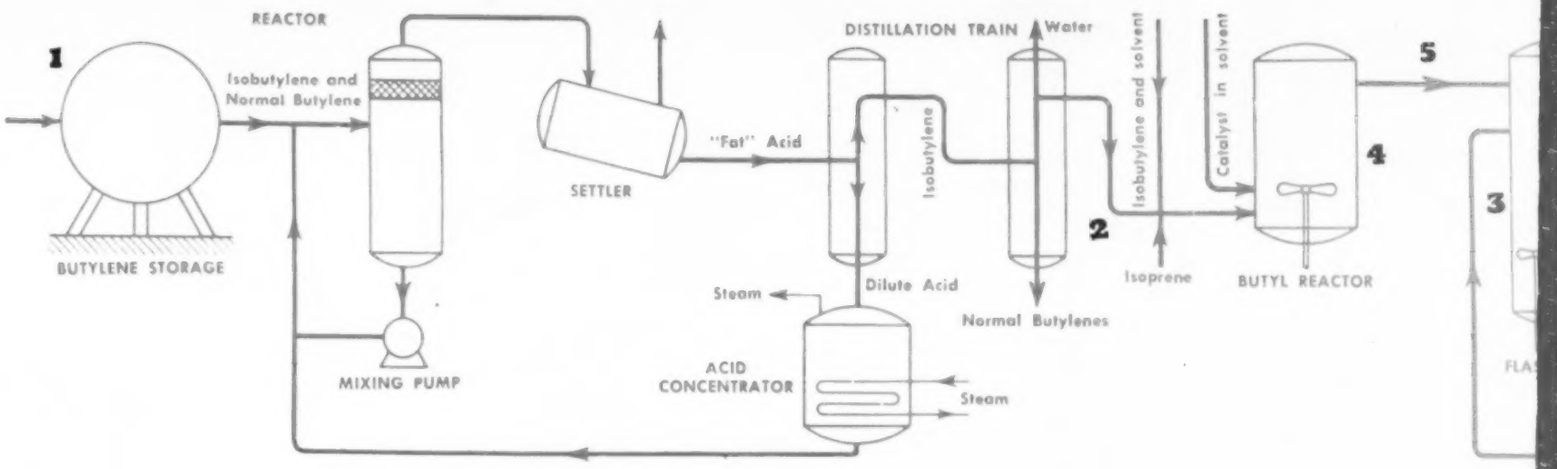


3 Flash drum used for the purpose of removing unreacted material is provided with agitator to maintain uniformity of slurry

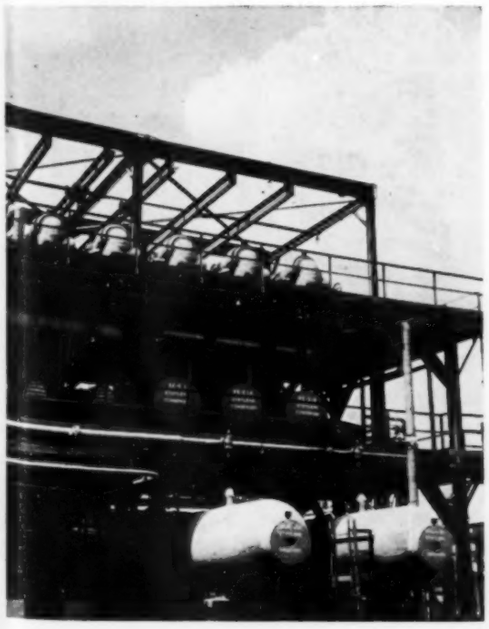


5 Unreacted isobutylene and diluent leaving reactor are treated and separated in a series of fractionating towers

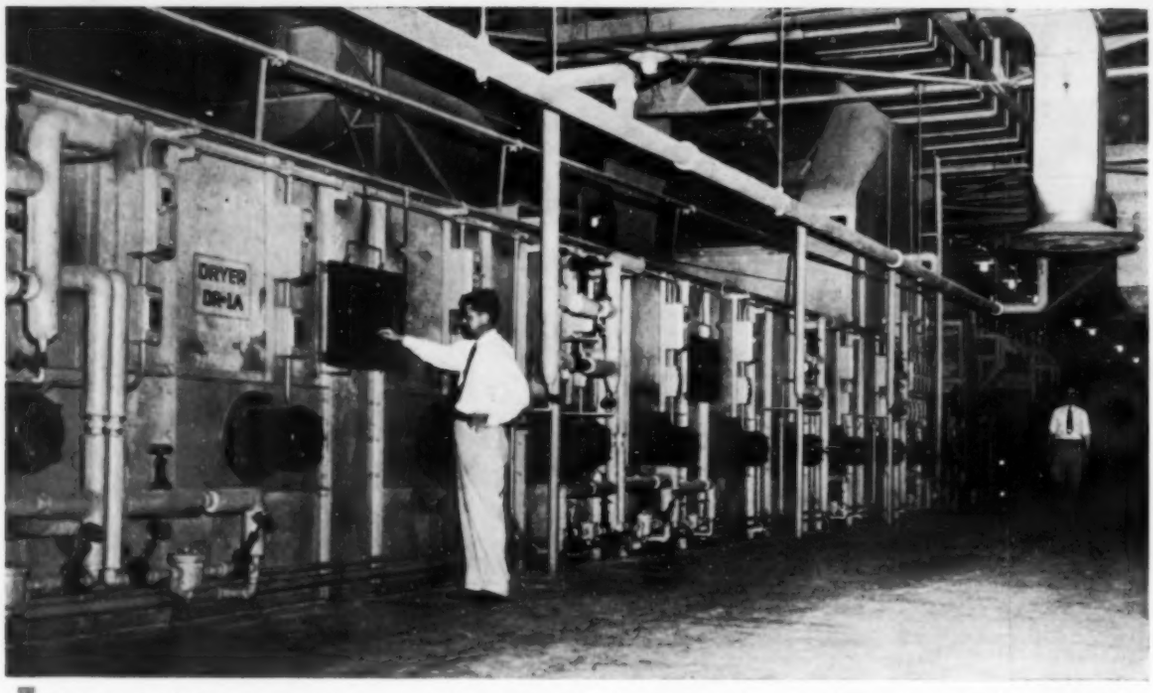
7 After mu
evaporated



4 Ammonia and ethylene are used for reducing temperature of feed stock to reactor to –150 deg. F.



6 After last traces of diluent have been removed from the polymer it is conveyed to the finishing building. Here a large portion of the water is removed by a vibrating screen



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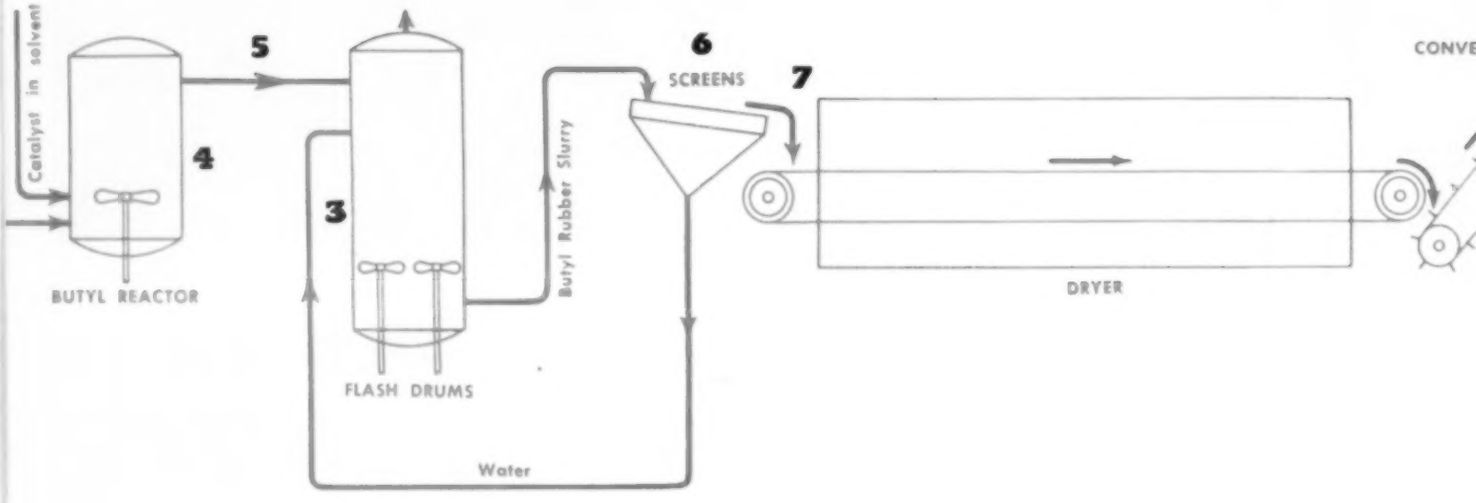
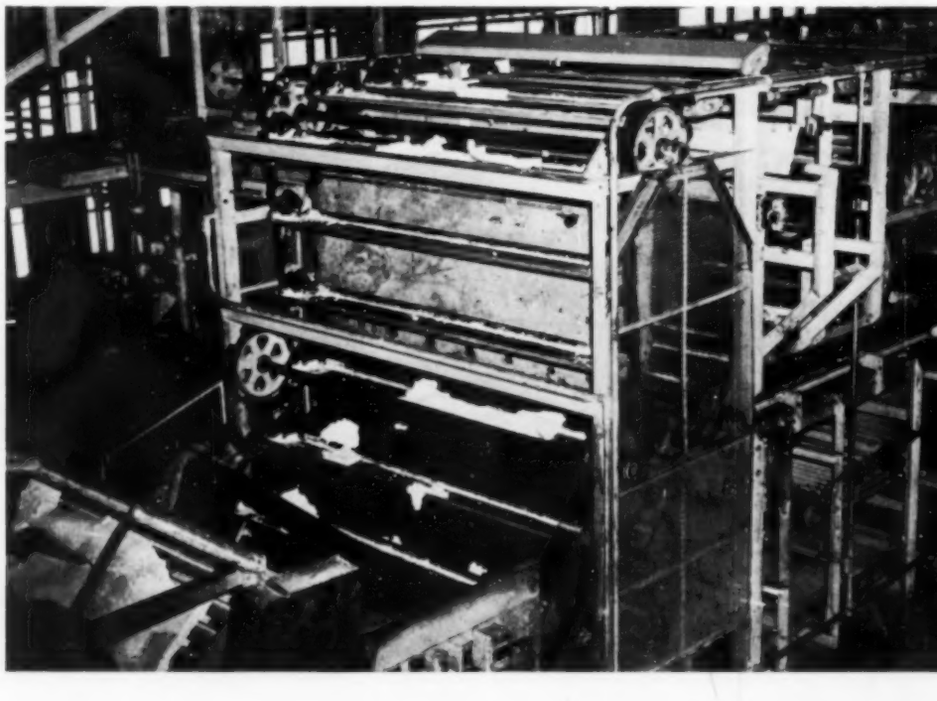
7 After much of the water accompanying the polymer has been removed on a vibrating screen, the remainder is evaporated while the rubber is making one pass through a tunnel dryer at temperature of 150–220 deg. F.



ner it is conveyed to the finishing
rating screen

8 Thoroughly dried synthetic rubber on leaving the tunnel dryer is conveyed either to an e
machine or rubber mill. The conveyor is shown here



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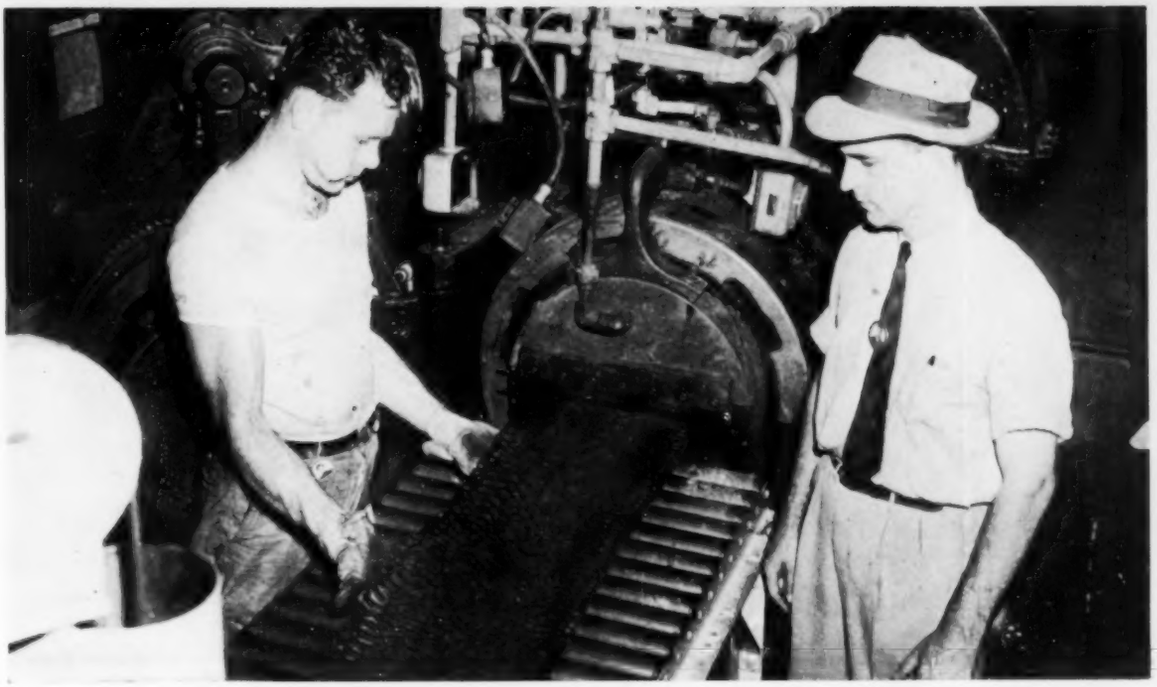
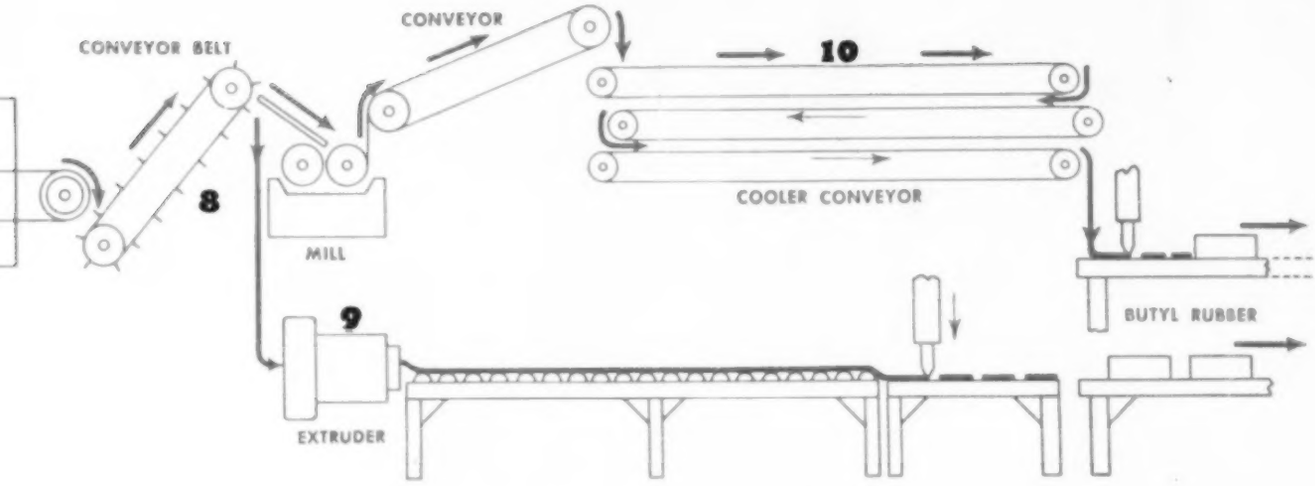
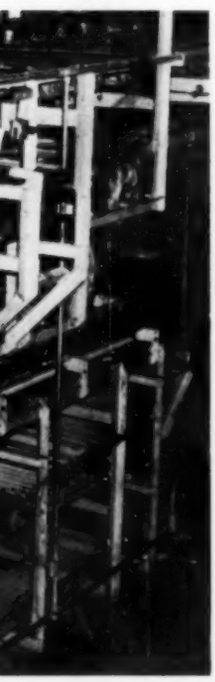


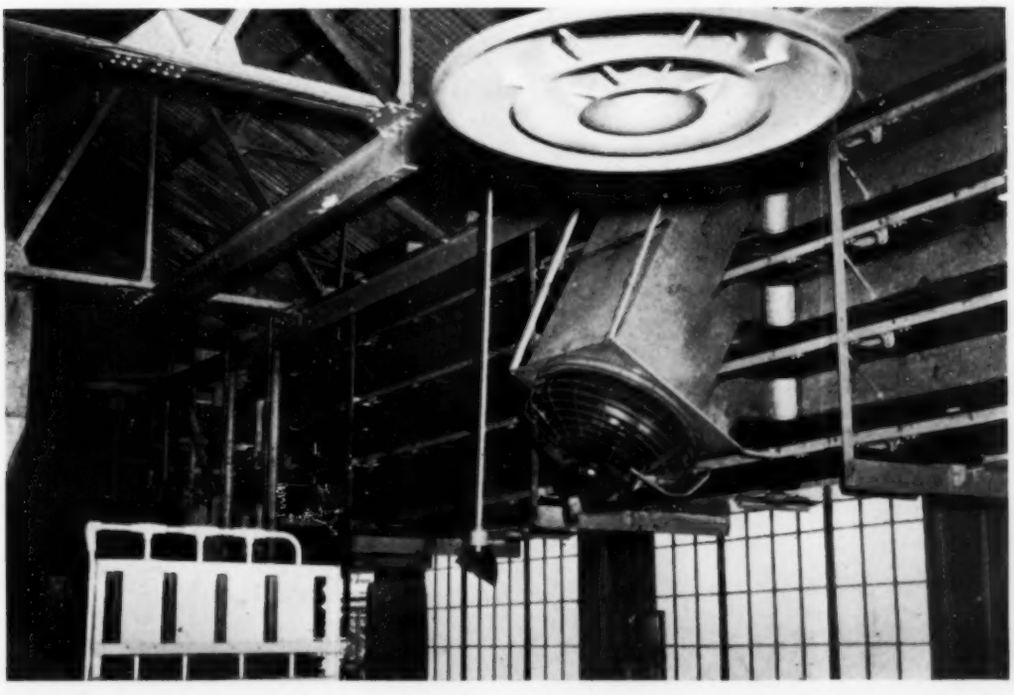
9 For certain applications the butyl rubber is extruded as shown here. On leaving the extruder it is conveyed a short distance where a knife cuts it into slabs. These slabs are wrapped and placed in cartons for shipment



either to an extruding

10 Butyl rubber that is milled must be cooled on several long conveyors before the rubber ribbon can be cut into slabs and packed in boxes for shipment





100 OCTANE GASOLINE *Depends on Instruments Like These—*

IN the operation of the new Fluid Catalytic Cracking Plants of the Standard Oil Company of New Jersey, a new refining technique has been perfected which provides for the simultaneous production of synthetic rubber raw materials and an improved quality of 100-Octane Gasoline.

In selecting and arranging equipment for these new refineries, nothing was spared to make these plants a model of efficiency and ease of operation. Helping to maintain operating efficiency are Brown Air-O-Line Recording Controllers (shown above) in the Central Control Room of the Fluid Catalytic Cracking process.

It is a tribute to Brown's engineering that leading refineries depend on Brown Instruments for precision control of temperatures, pressures, flows and liquid levels in the production of 100-Octane Gasoline.

Write for catalogs. The Brown Instrument Company, 4478 Wayne Avenue, Philadelphia, Pennsylvania, a division of Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

Instruments by **BROWN** *and Controls by*

MINNEAPOLIS-HONEYWELL

TIPS ON VALVE TRIM
TO HELP KEEP PIPING ON THE JOB
How to Repair Valves
11 SIMPLE WAYS TO GET BETTER SERVICE FROM PIPING EQUIPMENT
Short-Cuts to Faster Piping Jobs
FOR SPECIFIERS
FOR PIPEFITTERS
HOW TO KEEP YOUR PLANT GOING WITHOUT INTERRUPTION!
HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE

Ask for as many sets as you need. Requests filled as received while supply lasts.

YOU'LL FIND 'EM IN "PIPING POINTERS"

What to do when a tee can't be had—a globe valve—or a needed reducer? How to get jobs completed despite materials shortages? How to help themselves in emergencies is what today's piping maintenance men must learn if vital production lines are to be kept flowing.

For practical examples of wartime piping ingenuity, see Bulletin 6 of Crane "Piping Pointers." In the hands of your maintenance men, veterans as well as trainees, this bulletin can do much toward preventing delays on piping jobs. Anyone can use the maintenance short-cuts and the safe hints it gives on substitution of materials.

SENT FREE TO ANY PLANT

Aimed at speeding the war effort by helping all industry get better service from valves, fittings and piping, "Piping Pointers" are based on Crane Co.'s 88-year background in flow-control engineering. Your Crane Representative will gladly supply copies of Bulletin 6 and others in the series. Or, write to Crane Co., 836 S. Michigan Ave., Chicago, Ill.

ARMY E NAVY

CRANE VALVES

A Girdler plant produces HYDROGEN at lower cost than any other process!

Practically automatic! Continuous in operation! Actually pays for itself! Sizes for all needs!

Users of hydrogen gas in quantities from approximately 1,000 to 1,000,000 cubic feet per hour will find the Girdler Hydrogen Manufacturing Process provides H_2 at considerably less cost than heretofore possible. Savings are such that a Girdler plant often will pay for itself in less than three years.

Operating costs of a Girdler plant are usually from 30c to 50c lower per 1,000 cubic feet of hydrogen than any other process. This saving, of course, is contingent upon and varies with utility costs in different sections of the country.

A Girdler hydrogen plant is semi-automatic, and operates in a continuous manner. It is extremely flexible; may be run from 20% to 100% of rated maximum capacity.

Carbon dioxide is a valuable by-product of this process. It may be used for fire protection, prevention of oxidation and many other uses.

Write for free illustrated bulletin No. 103, giving description and data on the Girdler Hydrogen Manufacturing Process.

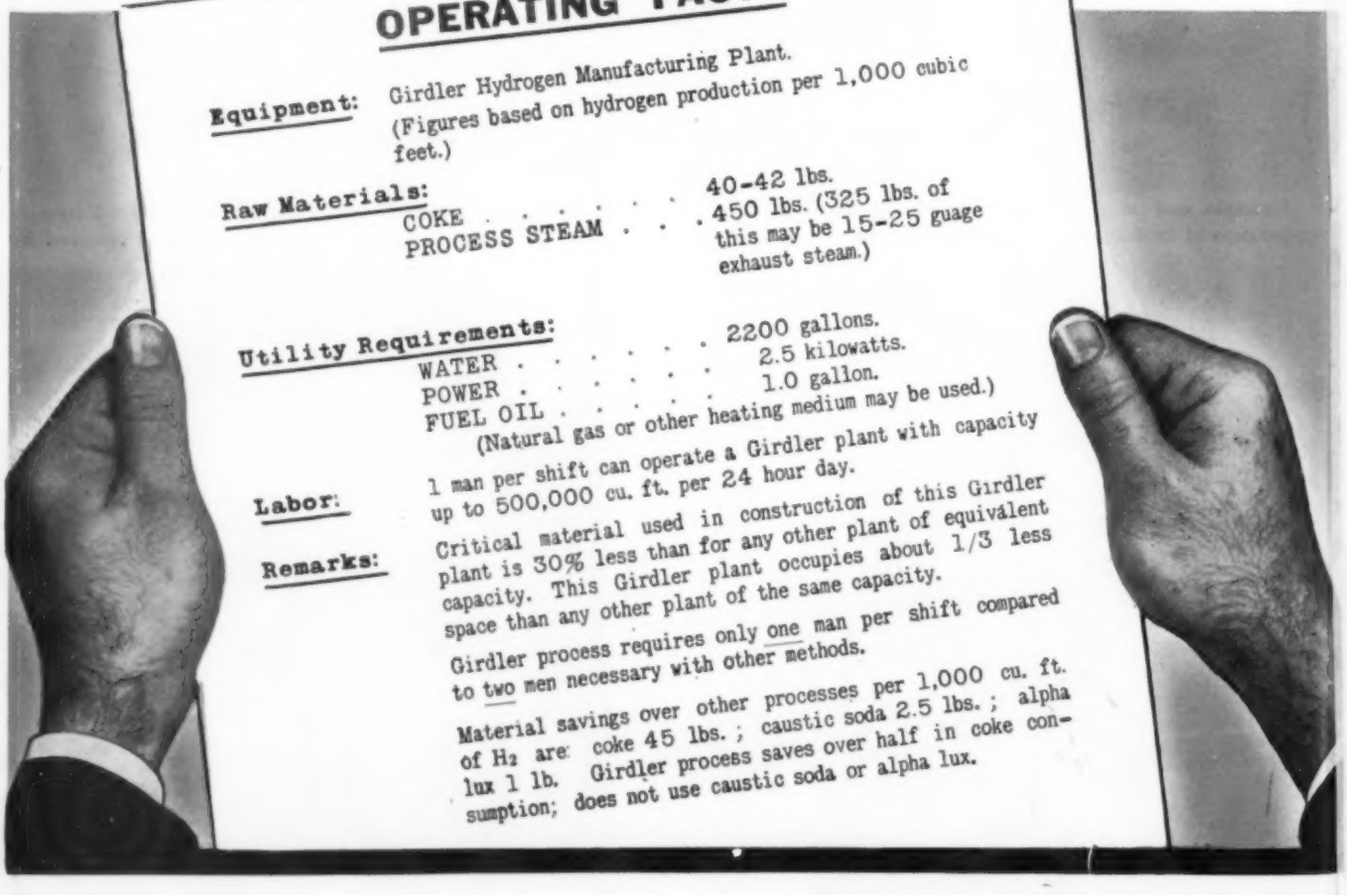
Do you use CARBON MONOXIDE?

Girdler offers several processes for manufacturing, purifying, dehydrating, separating or reforming various gases or mixtures. The Girdler Carbon Monoxide Manufacturing Process is one such process. It produces CO at an extremely low cost by utilizing stack, kiln or similar waste gases. The resulting carbon monoxide is pure and moisture-free. Write for illustrated bulletin No. 102.

The GIRDLER CORPORATION

GAS PROCESSES DIVISION — **LOUISVILLE, KENTUCKY**

OPERATING FIGURES PROVE *unusual* ECONOMY!



OPERATING FACTS

Equipment: Girdler Hydrogen Manufacturing Plant.
(Figures based on hydrogen production per 1,000 cubic feet.)

Raw Materials:

COKE	40-42 lbs.
PROCESS STEAM	450 lbs. (325 lbs. of this may be 15-25 guage exhaust steam.)

Utility Requirements:

WATER	2200 gallons.
POWER	2.5 kilowatts.
FUEL OIL	1.0 gallon.

(Natural gas or other heating medium may be used.)

Labor: 1 man per shift can operate a Girdler plant with capacity up to 500,000 cu. ft. per 24 hour day.

Remarks: Critical material used in construction of this Girdler plant is 30% less than for any other plant of equivalent capacity. This Girdler plant occupies about 1/3 less space than any other plant of the same capacity.

Girdler process requires only one man per shift compared to two men necessary with other methods.

Material savings over other processes per 1,000 cu. ft. of H_2 are: coke 45 lbs.; caustic soda 2.5 lbs.; alpha lux 1 lb. Girdler process saves over half in coke consumption; does not use caustic soda or alpha lux.

Chemical Engineering NEWS

FERMENTATION PROBLEMS RESULT FROM MOLASSES SHORTAGE

Serious difficulty is being experienced in several fermentation industries because of molasses shortage. Inadequate supply of lactic acid, citric acid, and yeast and yeast products, has appeared inevitable during the past month. A drastic corrective measure was attempted by W.P.B. in revising its Order M-54. Unfortunately the result was more trouble rather than less.

This Order M-54 relates to the distribution of molasses. The change made, in effect, provided that all beet molasses should be subject to allocation, instead of being used for sugar recovery in the Steffens process plants of the beet sugar industry itself. Actually, when the new form of M-54 was issued, the beet sugar men were told that they could plan this year's campaign on the assumption that they would have to ship all molasses instead of processing it in their own plants.

The primary purpose of Food Distribution Administration and W.P.B. in taking this action was to get this beet molasses as a fermentation medium to be used in making citric acid, lactic acid, and yeast products. They did not realize the secondary effects. But these were promptly brought to their attention by numerous divisions of industry. It was pointed out that about 120,000 tons of refined beet sugar would be lost from the American sugar bowls. The technology of beet sugar plants would have been completely upset because steam, power, labor, and other operating conditions would have been thrown completely out of balance. Some of the beet sugar makers immediately announced that they would not run their plants at all if they could not run the Steffens house as a part of the operation.

An incidental difficulty which developed was a threat of cutting off much mono-sodium glutamate. That chemical is made by Amino Products Company from the filtrate of the Steffens house. The loss of this glutamate would have completely upset many food programs which depend on that chemical as a flavor component of foods which must be made without meat, or with less meat than normal.

The revised order was hardly announced before its application was suspended. Now W.F.A. and W.P.B. are scurrying around madly to find ways in which to get more molasses products by fermentation, even including possible extensive new operations in Cuba and Puerto Rico. Much make-shift chemical engineering may be needed; but any gains made will not have secondary disadvantages greater than the supposed improvements achieved, it is hoped.

ROSTER NAMES COMMITTEE ON CHEMICAL DEFERMENTS

Improved procedure for handling deferments of chemists and chemical engineers has been set up by the National Roster of Professional Personnel. An advisory committee on chemists and chemical engineers has been named with the following personnel: Dean Frank C. Whitmore, Penn State College, chairman; F. W. Willard, Nassau Smelting and Refining Co.; Dr. Ernest W. Reid, former chemical executive of WPB; Prof. Warren L. McCabe, Carnegie Institute of Technology; and Lawrence W. Bass, director of New England Industrial Research Foundation. Active operations will be directed by Dr. W. T. Reed of Rutgers University, serving as a full-time member of the Roster staff and as executive officer of the advisory committee.

It is not desired that all deferment cases be sent to the Roster. Only those where local boards are in doubt should be submitted. Either the individual or the employer can communicate with the advisory committee, sending copies of correspondence and of Form 42A. Draft boards are also requested to send in cases on which they wish professional advice.

ALLIED CHEMICAL AND DYE CENTRALIZES RESEARCH

Early this month Allied Chemical & Dye Corp. announced plans for establishing a new central research laboratory at Morristown, N. J. Its activities will be in addition to those conducted by the several operating divisions and subsidiaries and will be directed initially to problems of war importance and the long-range program for the development of new products and processes for peace-time uses.

The company plans ultimately to erect the large modern research building shown in the accompanying architect's drawing. It will be built on property near Morristown acquired for that purpose late in 1942. Since the present critical condition on materials of construction precludes actual building at this time, an interim plan involving temporary facilities has been developed. A commercial building in Morristown has been leased and is being altered and equipped to accommodate a small staff. It is expected that the building will be ready for occupancy about Oct. 1.

The new laboratory will be headed by Dr. Dwight C. Cardwell, who has been associated with the company's research activities since 1926. Dr. Bardwell is a graduate of the University of California.

The Allied organization comprises the following principal operating groups: The Barrett Division, General Chemical Co., National Aniline Division, Semet-Solvay Co. and the Solvay Process Co. The fields of activity within Allied include coal-tar products and related materials, acids and heavy chemicals, dyestuffs and intermediates, coke and by-products, alkalis, chlorine, synthetic ammonia and nitrates. A number of plants have been erected and are being operated by Allied subsidiaries for the account of the United States Government.

New Research Laboratory Planned for Allied Chemical & Dye Corp.

The new home of Goodyear research in Akron, Ohio, which was dedicated with a two-day scientific program on June 22-23

GOODYEAR DEDICATES NEW RESEARCH FACILITIES

National leaders in science and industrial research joined with the executives and employees of the Goodyear Tire & Rubber Co. in the dedication on June 22-23 of the company's new research laboratory and expanded facilities for scientific investigation. A series of four symposiums on the subjects of synthetic rubber, plastics in war and peace, the future of chemistry and the future of transportation—all fields of intimate concern to Goodyear research—featured the two-day scientific program. P. W. Litchfield, chairman of the board and chief executive officer of the company, also made this the occasion for announcing a number of important research achievements including Plioflex, a vulcanized elasto-plastic substitute for rubber, Cycleweld, a new cement replacing riveting and welding in airplane construction, a supersonic tire tester utilizing the principle of electronics, a new resin plastic insulation material known as resin foam, and a new device for neutralizing radio static. These developments of interest to chemical engineers are reviewed elsewhere in this issue.

Built and equipped at a cost of $1,325,000, the new Goodyear research laboratory will provide facilities for the staff which consist of approximately 125 chemists, physicists, engineers and metallurgists along with clerical assistants and some 400 other research workers whose time is largely spent in field work. The building is of reinforced brick and stone construction, laid out in the form of a "U" and contains 74,000 sq.ft. of floor space distributed on three floors. On the ground floor are five large laboratories as well as machine shops and pilot plant facilities. The second floor contains a suite of eleven offices for managerial executives as well as a group of laboratories devoted to physics, X-ray studies and microscopic research. A dozen laboratories devoted to analytical and organic chemistry including one bomb-proof, are on the third floor.

The Goodyear company has long been recognized as a pioneer in the field of industrial research. Mr. Litchfield was one of the early graduates in chemical engineering from the Massachusetts Institute of Technology and when he joined the Goodyear company as its production manager in 1900, one of his first acts was to set up a design room to start the task of designing and building automobile tires. In 1902 he brought out his first tire, a precursor of the straightside tire which he developed in 1905. During ensuing years the company continued to lead the way with the cord tire, the pneumatic truck tire and the balloon tire. Simultaneously it pioneered in researches that led to the development of Captax, now the leading accelerator used in the rubber industry, and also in the development of important anti-oxidants. Two other important accomplishments have been Pliolite, used originally as a cement for joining rubber to metal but subsequently used as a corrosion-resisting coating for metal, and Pliofilm, the transparent film made from rubber by reacting it with hydrogen chloride.

In 1900 the Goodyear company had 160 persons on its payroll. In 1939 that number had increased to 46,194. As the result of war activities, total personnel reached 85,000 early in 1943 without counting employees outside the United States.

FRANK H. SHAW RECEIVES HYATT AWARD FOR 1942

The annual John Wesley Hyatt Award, established by Hercules Powder Co. in 1941, for outstanding achievement in the plastics industry was conferred for 1942 on Frank H. Shaw, president of Shaw Insulator Co., Irvington, N. J., at a dinner in New York on June 17.

Mr. Shaw received the award for having developed and perfected the transfer molding of thermosetting plastics, without which the production of many intricate and delicate plastic parts for war and industrial equipment would be impossible. The presentation was made by Dr. Per K. Frolich, president of the American Chemical Society, and a member of the Hyatt award committee.

CANADIAN THIOKOL PLANT IN OPERATION

First production of a rubberlike product in the British Empire was reported last month when the new plant of Naugatuck Chemicals, Ltd. was placed in full scale operation. Naugatuck Chemicals, Ltd. is an affiliate of the Dominion Rubber Co., Ltd. and the new plant, which is located in the Province of Ontario, is producing Thiokol which was developed by the Thiokol Corp. at Trenton, N. J. The new output has been placed at the disposal of the Canadian Government for use in war equipment.

Dr. J. E. Field of the Goodyear research staff is demonstrating the use of equipment to Major Turner, Major General G. M. Barnes, President E. J. Thomas and J. M. Linforth, Goodyear vice-president. The group is inspecting the ultra violet spectograph

CHEMICAL SHOW WILL DISCLOSE EFFECTS OF WAR INFLUENCE

A startling new chart of industry sustaining a world-wide war will be disclosed by the 19th Exposition of Chemical Industries which will be held in Madison Square Garden, New York, Dec. 6-11. Many industries have been completely reorganized and are now operating along new lines in producing materials, instruments, equipment and supplies that are needed in the war program, as well as arms and equipment for the fighting forces. New industries have been created by the emergency to manufacture substances unheard of before the war.

No summary of current events in industry could be as complete and stimulating as a gathering of the industries themselves through their representatives, for purposes of information, developing perspective and planning, such as the Exposition affords. Plans now being formulated by participating interests in materials, machines and production fields are already beginning to reflect some of the highlights of the new industrial relationships.

The first Exposition of Chemical Industries, held during World War One, served a definite objective in helping to establish chemical industry on a firm footing in this country. Several flourishing industries today, trace their beginnings to that first exposition.

The 18th Exposition, held in 1941, closed on the eve of the assault on Pearl Harbor, and the flood of inquiries which came to the management of the Exposition immediately indicated the readiness for action of this group of industries, and proved the benefit of intense cooperative spot study of the newest engineering technology.

The coming Exposition like its predecessors, is under the management of the International Exposition Co., of which Charles F. Roth is president. Unlike its predecessors, it will be limited in size, due to the restricted space available and the impracticability of gathering and showing heavy machinery at this time.

IMPROVED PROCESS PROPOSAL FOR MAKING ALCOHOL

Large economy in dollars and in malt may result from a new method being tested commercially for making industrial alcohol from wheat at beverage and industrial alcohol plants. This new method was discovered by Dr. A. K. Balls and Irwin W. Tucker of the Bureau of Agricultural and Industrial Chemistry just before the transfer of the enzyme laboratory from Washington to California. It consists in treating granular wheat flour with a very dilute solution of sodium sulphite as the first step in processing. The contained gluten is released and the enzymes activated. Removal of the coagulated gluten as a scum leaves a suspension and solution of starch and sugar. The conversion of the starch to sugar, making it available for fermentation, continues very effectively.

Commercial trials of the new process are being made at several industrial establishments. Technical difficulties are being ironed out; and it is hoped that commercial application in all of the plants making alcohol from wheat may begin in the very near future.

Preliminary results indicate three major advantages. The recovery of gluten is easy and practically complete without handling of thin slops. The requirement for malt is reduced or perhaps completely eliminated. And the yields of alcohol are apparently maintained at nearly the same level per hundred pounds of granular wheat flour used despite the fact that malt is not present in its customary quantity. Certainly the quantity of granular flour required to supplant the malt saved will be much less than pound for pound, according to preliminary trials.

BOOK PUBLISHERS VISIT SOUTH AMERICAN REPUBLICS

Under the auspices of the Department of State and the Office of the Coordinator of Inter-American Affairs, publishers representing all phases of book publishing set out last month for a six-weeks tour to include Mexico, Columbia, Peru, Chile, Argentina, and Brazil. Those making the trip included George P. Brett, Jr., president of the Macmillan Co., Burr L. Chase, president of Silver Burdett Co., Robert F. DeGraff, president of Pocket Books, Inc., Malcolm Johnson, executive vice-president Doubleday, Doran, and James S. Thompson, executive vice-president, McGraw-Hill Book Co.

Members of this group will consult with publishers, government officials and others who are concerned with education, cultural and commercial relations, officers of professional associations, and directors of schools and research centers.

FOR PRODUCTION EXCELLENCE

Among the companies which, in the past month, have been awarded the honorary Navy "E" and joint Army and Navy "E" burgee for exceeding all production expectations in view of the facilities at their command, are included the chemical and explosives plants, the chemical process industries and the chemical engineering equipment concerns listed below. Other process and equipment plants will be mentioned in these columns as the awards are presented to the individual plants.

American Chain and Cable Co., Philadelphia.
The Union Metal Mfg. Co., Canton, Ohio.
Watkins, Inc., Wichita, Kan.
Westinghouse Electric and Mfg. Co., Philadelphia.
Accurate Steel Treating Co., Chicago.
Ace Mfg. Corp., Philadelphia.
Advance Stamping Co., Detroit.
American Cyanamid Co., Linden, N. J.
American Finishing Co., Memphis, Tenn.
American Potash and Chemical Corp., Trona, Calif.
American Smelting and Refining Co., Garfield, Utah.
American Thread Co., Dalton, Ga., and Holyoke, Mass.
American Viscose Corp., Marcus Hook, Pa.
Amana Society, Amana, Iowa.
Atmospheric Nitrogen Corp., Ohio River Ordnance Works, Henderson, Ky.
Automotive Maintenance Machinery Co., Chicago.
The Barre Wool Combing Co., Ltd., South Barre, Mass.
F. W. Berk & Co., Inc., Woodridge, N. J.
Berry Brothers, Detroit.
Blaw-Knox Co., Blawknox, Pa.
Brighton-Advance Corp., Brighton, Mich.
Buckeye Wool Pulling Co., Cincinnati.
Callaway Mills, LaGrange, Ga.
Cannon-Kocka Co., Cleveland.
Chambersburg Engineering Co., Chambersburg, Pa.
The Christensen Machine Co., Salt Lake City.
Cincinnati Ball Crank Co., Cincinnati.
The Cincinnati Gear Co., Cincinnati.
Crosse & Blackwell Co., Baltimore.
Darlington Veneer Co., Inc., Darlington, S. C.
Deere & Co., Moline, Ill.
Delta Finishing Co., Philadelphia.
Delta Oil Products Co., Milwaukee.
Detroit Gasket and Mfg. Co., Detroit.
Eugene Dietzen Co., Chicago.
Dunn Woolen Co., Martinsburg, W. Va.
E. I. duPont de Nemours & Co., Inc., duPont, Wash. and Oklahoma Ordnance Works, Pryor, Okla.
Eastern Rolling Mills, Baltimore.
Eastern Tool and Mfg. Co., Bloomfield, N. J.
Felker Mfg. Co., Torrence, Calif.
Fisher Governor Co., Marshalltown, Iowa.
General Electric Co., Plastics Department, Pittsfield, Mass.
General Instrument Corp., Elizabeth, N. J.
General Machine Co., Newark, N. J.
William D. Gibson Co., Chicago.
A. C. Gilbert Co., New Haven, Conn.
Graham-Paige Motors Corp., Detroit.
Hammond Iron Works, Warren, Pa.
Hercules Powder Co., Belvidere, N. J.
Jacobs Mfg. Co., West Hartford, Conn.
J. O. Mfg. Co., Southgate, Calif.
A. F. Jorss Iron Works, Inc., Washington, D. C.
The Kendall Co., Griswoldville, Mass., Slaterville, R. I. and Walpole, Mass.
Lebanon Steel Foundry, Lebanon, Pa.
Lisle Corp., Clarinda, Iowa.
Lufkin Foundry and Machine Co., Lufkin, Texas.
Magnetic Pigment Co., Trenton, N. J.
J. A. Maurer, Inc., New York.
McKiernan-Terry Corp., Dover, N. J.
National Malleable and Steel Castings Co., Indianapolis.
Niagara Alkali Co., Niagara Falls, N. Y.
Nickey Brothers, Inc., Memphis, Tenn.
Nunnally McCrea Co., Inc., Atlanta, Ga.
Pelton & Crane Co., Detroit.
Pepperell Mfg. Co., Fall River, Mass., Lindale, Ga., and Opelika, Ala.
Pettibone Mulliken Corp., Chicago.
Pittsburgh Lectromelt Furnace Corp., Pittsburgh.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
William Powell Co., Cincinnati.
Quality Tool & Die Co., Indianapolis.
Remington-Rand, Inc., Sangamon Ordnance Plant, Illiopolis, Ill.
Richards Brush Co., Seattle, Wash.
Scanlan-Morris Co., Madison, Wis.
United States Bronze Powder Works, Inc., Closter, N. J.
United States Pipe and Foundry Co., Birmingham, Ala.
United States Potash Co., Carlsbad, N. M.
Vermont Marble Co., Procter, Vt.
Western Machine Tool Works, Holland, Mich.
Westinghouse Electric and Mfg. Co., Mansfield, Ohio and Newark, N. J.
West Point Mfg. Co., La Grange, Ga.
Worcester Pressed Steel Co., Worcester, Mass.
Zimmerman Steel Castings Co., Bettendorf, Iowa.

MARITIME COMMISSION "M" AWARDS

The following companies have been awarded the Maritime Commission's "M" pennant, the maritime victory flag, and labor merit badges for the workers for excellence in production:

The Air Preheater Corp., Wellsville, N. Y.
Air Reduction Co., Inc., New York.
The Bevis Machine Co., Middletown, Ohio.
General Cable Corp., New York.
Ingalls Iron Works Co., Inc., and Birmingham Tank Co., Birmingham, Ala.
Lynchburg Foundry Co., Lynchburg, Va.
Martin-Parry Corp., York, Pa.
Pennsylvania Range Boiler Co., Philadelphia.

WASHINGTON NEWS

NUMBER one fear in Washington is the public's growing belief that the Army, Navy and Maritime Commission are over-shooting in planning their requirements and that actually the time has come when the war effort can ease off in favor of peacetime activities. Evidences of public complacency are a cause for real alarm among high production officials. It is a feeling that has even hit the Army according to General McNair, who said on his return to active duty that the success of the Tunisian campaign had bred over-confidence among the troops. A situation has developed that threatens the success of the entire production program.

Under Secretary of War Patterson has shifted his attentions from Rubber Czar Jeffers to the lagging production program. The Army high command is disturbed by the decline of three and one half percent that occurred in May instead of the scheduled two percent rise. Warned the Under Secretary, "Management and labor must deliver the supplies on schedule and as planned or the opportunity to exploit recent military successes will be lost. I would attribute the letdown in May to overconfidence inspired by the Tunisian victory and the success of the European bombing; to baseless rumors of vast quantities of Army supplies being stored up here in America far beyond our abilities to transport overseas, and to the mistaken belief on the part of many that materials in great quantities will shortly become available for the conversion of many war facilities to the production of less essential civilian items."

Production Goals

Goal of the services in 1943 is a production of war material amounting to 83 billion dollars. To reach this figure the rate of production in the last half of the year must be 50 percent greater than it was in the first half. The temporary goal for 1944 calls for an increase of at least 25 percent over this year's effort. As the appropriations are passed by Congress the contracts for this production are being let. Neither management nor labor need fear cutbacks. While it is true that some munitions have been piling up, the shooting war is yet to come. From a military standpoint the country is fortunate to have these surpluses.

Figures for production in the first half of the year are not yet available but estimates put it at about 41 percent of the goal. On a rising production curve this is not as bad as it might appear. It must be apparent that production in the first quarter must have been below 25 percent of the annual goal and in the last quarter the expectation is that considerably more than 25 percent of the goal will be produced. Actually first quarter figures showed about 19 percent with second quarter estimated to be about 22 percent. This is the basis for statements that production in the last half of the year must be 50 percent greater than the first half if the production goals are to be reached.

Importance of Chemicals

From two sources come figures showing the part played by the chemical industry in the war effort. The report to President Roosevelt by Donald Nelson, Chairman of the War Production Board, on 1942 activities and 1943 production prospects was made public in summary form in mid-June by the Office of War Information. The report (secret for security reasons) stresses the formidable program for 1943. The following paragraphs quoted from the OWI summary give what many believe to be the first official recognition of the part played by the chemical industry in the war effort. Bear in mind that the material on which the report was based was collected last December.

"Direct military consumption of aluminum in 1942 was 1,177,000,000 pounds, or 168 percent higher than in 1941. In 1941 about two-thirds of military consumption of aluminum was for aircraft; in 1942 the ratio had risen to almost 80 percent. Exports of aluminum rose by 336 percent. The story for other materials is similar.

"This increased flow of materials into direct military production and exports came chiefly from the expansion of domestic supply and the reduction of certain civilian uses. The domestic output of many key materials increased substantially in 1942. Production of chromite rose by almost 700 percent during the year; magnesium by 220 percent; aluminum by 77 percent; alloy steel by 38 percent; molybdenum, tungsten and vanadium by 40 percent.

"Due to lack of shipping space and the cutting off of many sources of supply, chief increases in imports of materials were of materials which normally came in large volume from other American countries—copper, nickel, aluminum, bauxite and nitrates. The shipping shortage interfered severely even with shipments from nearby sources, such as molasses from Cuba for the production of alcohol.

"On the basis of programs envisaged in December, 1942, the needs of military production during 1943 call for substantially greater quantities of almost all critical materials than in 1942. Direct military requirements for steel are up 31 percent. Aluminum mainly for airplane manufacture, and nitrogen, for explosive production, are up over 100 percent. Phenol and toluene, also essential for the production of explosives, are likewise up over 100 percent. Magnesium is up considerably over 200 percent."

Magnesium Surplus

Magnesium is becoming a hot potato. Washington is watching with great interest the behind-the-scenes efforts of the agencies that put up the money for the construction of magnesium plants to insure the liquidation of the debt without loss to the government and efforts of the agencies that laid out the construction program to justify the expansion of facilities. An unwieldy surplus of magnesium seems to be developing because fabrication techniques have not been satisfactorily worked out.

The difficulties are reminiscent of the early problems encountered in the fabrication of aluminum. Producers of magnesium claim that economical shop methods for the successful punching, bending and deep drawing of the metal have been found. However, magnesium is not accepted by the Army and Navy in aircraft production for load carrying members except in cast form.

Castings machine beautifully with little danger of fire if the operator knows his business. But machines on which magnesium has been cut must be thoroughly cleaned of magnesium dust before steel can be worked with safety. Indications point to immediate emphasis on extrusions. The over-all picture presents such a difficult problem that magnesium producers probably will handle fabrication as well as production of the metal in the future.

Potash Under Control

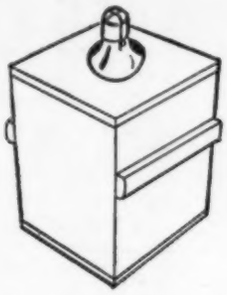
Potash has been brought under strict control. Prices of domestic sales were set by OPA on a specific dollars and cents ceiling in mid-June. The OPA regulation also rolls back the prices at which imported potash may be sold to fertilizer manufacturers making the price for imported and domestically produced potash the same. This is to prevent sales of the imported product from upsetting the domestic market.

Simultaneously distribution of the domestic production of potash was put under allocation by the War Production Board, in spite of the fact that production during the next 12 months is expected to be the largest on record.

Immediately following the announcement of the control measures, the ban on leasing potash lands was lifted.

At the moment domestic production is greater than the combined domestic production and imports before the war. It can be asked with propriety the reason for the sudden change in policy on the part of the Department of Interior. It is doubtful if new facilities can be established in time to do any good before the war is over and present capacity is more than enough to take

What every workman should know

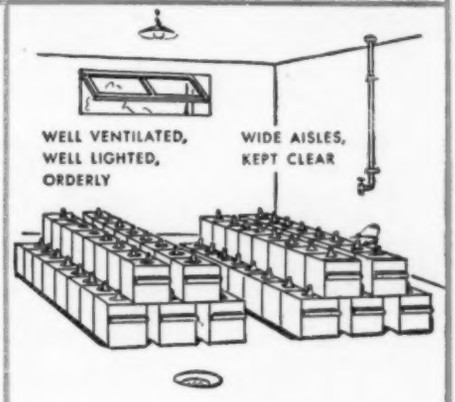


about handling acids in carboys

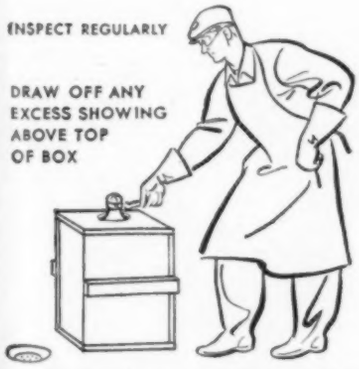
...to avoid interruptions in Victory Production

Men should be thoroughly instructed, properly clothed. Before moving, carboys should be inspected for leakage, loose stoppers. They should never be handled by neck or with hooks.

Thrust prongs of special truck under carrying cleats of carboy, then lift by bearing down on handles. Boxed carboys should *never* be "walked" on their lower edges.



Cinders or concrete treated with sodium silicate are best for storage floors. On dirt floors, place carboys on 2″x 4″ supports. Three tiers high is maximum, two preferable.



In hot weather loosen stoppers of carboys containing volatile liquids to vent pressures that might cause breakage. Provide drainage in storage space in case of breakage.

When opening carboy, keep hands, face to side... never over neck. Never twist or pry off wire holding stopper... use face-type wire cutters. Never empty by applying air pressure.

Finally, never use a carboy to hold anything but same product it originally contained. Drain completely to prevent spillage in rehandling. Return as promptly as possible.

These suggestions are offered as reminders to all who handle acids in carboys... and particularly as reminders to those who are charged with training new employes. They are based on one of a series of bulletins published by the Manufacturing Chemists' Association. For specific chemicals conservation suggestions for your plant or assistance in training new employes to handle chemicals safely, write: MONSANTO CHEMICAL COMPANY, St. Louis, Missouri.

MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

"E" FOR EXCELLENCE—The Army-Navy "E" burgee with two stars, "representing recognition by the Army and the Navy of especially meritorious production of war materials" over a two-year period, flies over Monsanto.

care of domestic requirements in the post war period. An effort to enter post war competition for the export market if successful will result merely in dissipating a natural resource. Men in the industry explain that areas of low cost production are widely scattered in foreign countries where their location for competition in the export market is much more advantageous than the deposits in this country.

In the meantime, the fertilizer industry will go on short rations.

Tin Situation Improved

Operation of the Texas City tin smelter is now well into the second year. A survey of the first year's operation shows the tin situation improved. During the year, industry was permitted to use about as much tin as normally while production of virgin metal at the smelter combined with the substantial tonnage of reclaimed tin has permitted a few thousand tons to be added to the stockpile.

Great credit is due the metallurgists in handling the difficult Bolivian ores. American technical skill also has improved mining operations. Result is a greater tonnage of ore being brought to the surface with more tons of metal being recovered per ton of ore taken from the ground and a higher percentage of metal in the concentrates shipped from Bolivia to Texas City.

Official Washington is giving thought to whether or not the Texas City smelter should be kept in operation after the war, using the Malayan ores rather than those from South America. It is claimed that the operation could be maintained without subsidy. There are some officials who believe a small subsidy should be provided if necessary. This idea does not appear to have congressional backing at the moment.

Lard for Soap

The acute shortage of fat for making glycerine via the soap kettle may be eased. A fortunate and unexpected source of material has been found in the surplus lard in the hands of some small packers many of whom operate plants not under government inspection. Tallow and grease production is down causing a shortage of the principal raw material for the soap industry while restricted imports of coconut and palm oils have added to the difficulties. Soapers have indicated a willingness to pay considerably above the white grease ceiling for the lard, much of which can not be held longer for edible use. Both packer and soaper would be benefited.

The extent of shortage of fats for soapmaking has been variously estimated at from half a billion pounds up. Strangely the half billion pound shortage is the estimated amount of fat that could be salvaged by the packers by closer trimming of carcasses. At the moment only the packing industry is permitted to waste fat. Vegetable oils are closely controlled and the government is actually buying the entire peanut crop for crushing.

According to government reports hogs are going to market weighing from 250 to 255 pounds—about 25 pounds above the economical feeding limit. The extra 25 to 30 pounds per head is largely fat which has been put on the animals at a great cost in feed. Lard produced per head has declined on the average almost three pounds in the last two years while the average weight of hogs slaughtered has gone up to 25 to 30 pounds. The answer, of course is that the fat is worth more as meat than as lard.

Salvage of household fat becomes even more important because of the amount of animal fat being sold to the public as meat. Figures indicate that attempts to salvage this fat has met with indifferent success. No amount of ballyhoo has been able to change the conviction of Washington observers that if the country needs fat the fat must be collected at the packers' level.

If moral factors can be overcome basis for sales of lard to soap makers will be the hardship clause of FDO 42. Hardship will be claimed in two directions—no market for lard and no raw material for soap. An additional consideration also advanced is the possible easing of the glycerine situation.

In case lard is sold for soap making it is expected that purchases will take title at the point of shipment where the lard will be denatured to take advantage of the lower freight rate on the inedible product. This will also forestall any question that might arise concerning shipping in interstate commerce of edible fat produced without the benefit of government inspection at the packing plant.

Soap resulting from such transactions will be of high quality and will no doubt be marketed as high priced toilet soap. A high-priced soap is the only soap that will be able to absorb the extra cost of the raw material which may amount to as much as 5 cents a pound, difference in the ceiling price of lard and that of tallow and grease.

Soap manufacturers who think that it may be possible to get their price ceilings raised by OPA on the basis of higher raw material costs are doomed to disappointment.

Larger Export Demands

Exports were also scheduled to advance substantially for most materials, copper again constituting an important exception. Outstanding is a sevenfold expansion in magnesium shipments, principally for the United Kingdom airplane and incendiary bomb programs. Exports of toluene, for the production of explosives abroad, are expected to rise about 70 percent.

With few exceptions, these increased requirements for materials for military use and for export during 1943 must be met through corresponding increases in new supply during the year, that is, from added domestic production and higher imports.

Unlike the situation which prevailed at the start of 1942, only limited quantities of most scarce materials can be rendered available by further reduction in the civilian economy. Nor is it possible, for most materials, to deplete stocks further without endangering the production program itself.

By the end of 1942, restrictions on non-essential uses of most metals had become so rigid that virtually no further diversion to military production can be expected from this source. The restrictions in effect at the beginning of 1943 were severe. Allotments for such uses as railroad equipment and maintenance, agricultural tools and machinery, and industrial repairs and maintenance are being increased above estimates made last December.

Supporting figures showing the sharp expansion in the production of chemicals are to be found in the Federal Reserve Board indexes (1935-1939 = 100).

Month	Chemicals	All Industry
Aug. 1939	97	96
Nov. 1941	149	167
April 1943	217	203

Expansion of production has been in the basic materials needed for war such as aluminum, alcohol, magnesium, ammonia, chlorine, toluene and other basic materials. There has been a marked decline in production of chemicals going for ultimate non-military consumption.

Maintenance and New Building

About July 1 new forms will be sent chemical producers operating under P-89 for fourth quarter quota applications for maintenance, repair and operating supplies. These forms must be returned within 45 days, and the chemical industry has been urged to fill them out and return them sooner if possible. The form will be WPB-1765 which was formerly PD-762.

There are no changes of consequence contemplated in the maintenance and repair order P-89. Reports from the War Production Board and from the industry are that the order as it stands is meeting requirements very well.

Inquiries from prospective applicants for permission to construct industrial facilities have multiplied within recent weeks according to the Construction Advisory Service of the WPB Facilities Bureau. Due to the general curtailment in facilities construction, companies desiring new facilities have been seeking information as to what considerations now govern the granting of authority to begin construction and obtain appropriate priorities.

The Construction Advisory Service is an expansion of services previously available to advise manufacturers and builders on the basis of preliminary drawings and opproximate listings of building materials before they submit formal applications to begin construction. Applicants, their architects, engineers, and other employees may avail themselves of these services before preparation of final drawings.

Through this procedure applicants familiarize themselves with currently permissible types of construction and materials, and avoid unnecessary delays resulting from redesigning projects and from the submission of incompletely prepared applications.

Why the Vane in the MULTICLONE Improves Dust Collecting Efficiency

Uniform Gas Distribution Aids Dust Recovery

THE KNOWLEDGE gained from over 36 years of research and development in the science of dust, fume and fly ash control—starting with the first commercial application of COTTRELL Precipitators—has gone into the MULTICLONE. And one of the outstanding advancements embodied in its design is the *vane* which guides the gases in each individual tube. Here's why it is so important...

▶Mechanical separators remove suspended particles from a gas by whirling it into a cyclone, thus centrifugally cleaning the gas of the suspended solids. The efficiency of this action is greatly influenced by the uniformity with which the whirling gas is distributed in the tube. More uniform distribution eliminates secondary eddy currents and gives centrifugal forces a greater chance to act on fine as well as coarse particles. Result—*more complete recovery of ALL suspended materials!*

The VG Type MULTICLONE

IN CONVENTIONAL CYCLONES the gas enters the tube through a single port in the side. This tends to concentrate the gas flow into a single spiral, leaving open spaces where eddies and secondary types of flow can form. These cause turbulence which impairs the cleaning efficiency!

IN THE MULTICLONE, the vane distributes the gas into eight smaller cyclones uniformly spaced around the separating tube. This finer "breakup" smoothes the flow and eliminates dead areas, thus promoting better separation and resulting in higher recovery, improved efficiency!

ADDITIONAL ADVANTAGES: Besides improved recovery efficiency, the Vane Type MULTICLONE requires no costly manifolding, therefore is simpler to install and to insulate. It is fireproof... and is maintenance-free because it has no filters or screens to clean, no moving parts to repair or replace. It is more adaptable because tubes can be quickly added to or removed from the MULTICLONE to meet any change in flow requirements!

The above are only a few of the *many* basic advantages built into the MULTICLONE. Get ALL the facts before installing *any* equipment for the collection of suspended solids from gases. Send for booklet describing MULTICLONE design and operation!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

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READERS' VIEWS AND COMMENTS

Readers are invited to express their views on articles appearing in Chem. & Met. *or on other subjects of interest to chemical engineers. As far as our space permits such views and comments will be published in these columns. Address your letter to the Editor of* Chem. & Met., *330 West 42 St., New York, N. Y.*

INSECTICIDE CRYOLITE

To the Editor of CHEM. & MET.:

Sir:—We have read with interest the article entitled "Insecticide Chemicals Needed for the War Food Supplies," by R. S. McBride which appears on page 101 of the March issue of CHEM. & MET. As manufacturers and refiners of natural cryolite used for insecticide purposes we wish to call your attention to one point in the article on which Mr. McBride is evidently misinformed.

On page 102 the following statement is made: "Practically all cryolite is used by dusting, in the form of a very fine ground product. It must be applied to apple orchards with the same equipment as is used for spraying of liquid arsenicals. There remains, therefore, a question as to the capacity of dusting equipment in existence in the orchard areas to utilize increased cryolite insecticides if produced."

This is definitely not the case because cryolite is applied to apples as a spray only and as such is applied with the same equipment used for spraying with arsenicals. Of course, we do not know who furnished this information to Mr. McBride, but evidently this person was not aware of pest control practices with respect to codling moth control.

J. D. BRUNTON
Pennsylvania Salt Manufacturing Co.
Philadelphia, Pa.

CORRECTION

In our May issue, an advertisement of the Floridin Co. was illustrated with a view of a solvent treating plant of the Continental Oil Co., mistakenly labelled as hydrofluoric alkylation units. The advertiser has been informed that no such unit is included in the plant represented. The advertisement will not appear again until a correct illustration is substituted.

DEHYDRATED MOLASSES

To the Editor of CHEM. & MET.:

Sir:—I notice in your June issue of CHEM. & MET., p. 147, you state that the scientists and engineers of the Board of Economic Warfare have developed a process for dehydrating molasses and shipping it in paper bags. The sugar people have been dehydrating molasses, I believe, for at least half a century. There is nothing new about it. In fact, in 1922 I handled dehydrated molasses in several-hundred-pound blocks packed in reed baskets. I made a plant layout for receiving and processing this material which was to be shipped from Java, so you see the statement does not jibe with the facts. India and Java were producers of solidified molasses.

Handling in paper bags would make an awful mess. Furthermore, why ship paper bags to Puerto Rico and Cuba when they can weave reed baskets?

A. DISTILLER

READERS' RIGHTS

From time immemorial it has been the privilege of readers to send their comments, critical or approving, to the editor of any journal which might chance to arouse their interest. Perhaps "from time immemorial" goes too far back to be strictly accurate. Webster's Unabridged says that in the year 1276 it was officially decided that legal memory went back to the year 1189, *i.e.* to the beginning of the reign of Richard I. The ages previous to this were "time immemorial" and unbroken possession of any right since that date was deemed sufficient evidence of the validity of the original grant. Perhaps, then, it would be more accurate for us to say that since the founding of our country we have enjoyed the privilege of telling an editor what we think of his publications.—*Silicate P's & Q's*

● Taber "General-Use" Pumps for the Processing and Chemical industries are not subjected to costly "one-purpose" pump waste. Merely changing Impeller and Casing fits Taber Pumps for various services.

Helpful Bulletin CLVS-339 on request.

No. 9415

TABER Pump Co. Established 1859 294 ELM STREET BUFFALO, N. Y.

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POLYPHASE:
Squirrel Cage ..... ½ to 15 h.p.
Double Squirrel Cage ..... 3 to 15 h.p.

SINGLE PHASE:
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Capacitor Type ..... 1/30 to 1½ h.p.
Split Phase ..... 1/30 to 1/3 h.p.
Direct Current ..... ⅛ to 3 h.p.

BALDOR ELECTRIC COMPANY ST. LOUIS MISSOURI

BALDOR BETTER MOTORS

INTERPRETING WASHINGTON

EDITOR'S NOTE: *Copies of the orders, rules and regulations covered in this installment may be obtained by writing to the appropriate federal agency, citing the order number or release date.*

FORM PD-200

WPB on June 15 announced that Form PD-200, formerly used to make application for authority to begin construction and for priority assistance, had been replaced by a new form known as WPB-617.

SEAMLESS FINNED TUBING

Limitation Order L-126 was amended on June 26 by WPB to permit the use of seamless steel tubing in the manufacture of finned coil or tube assemblies as part of refrigerating equipment until September 15, 1943. The amendment was made for those manufacturers who must expand the tubing to make the bond between it and the fins. The present amended Order is a temporary expedient until manufacturers can obtain suitable welded steel tubing.

MOTORS AND GENERATORS

General Conservation Order L-221, as amended, effective June 18, eliminates the necessity of purchasers of machinery into which is incorporated a special electric motor or generator, to file a certification setting forth the use and purpose of the motor or generator.

FANS AND BLOWERS

General Limitation Order M-280, as amended, effective June 21, removes the necessity of manufacturers of fans and blowers to file monthly detailed delivery schedules. Selected manufacturers now file delivery schedules on Form PD-901 under the terms of General Scheduling Order M-293. Acceptance of purchase orders is now restricted to those with Preference Ratings of AA-5 or higher, without regard to dates.

DRIVE GUARDS AND HOUSINGS

General Limitation Order L-193 was amended on June 11 by WPB to permit the use of steel in the manufacture of guards or housings on mechanical power transmission drives.

LIQUID PUMPS

General Limitation Order L-246 as amended, effective June 18, eliminates from the definition of liquid pumps, pumps used in the operation of passenger automobiles, trucks, truck trailers, passenger carriers, off-the-highway motor vehicles and motorized fire equipment, as defined in Limitation Order L-158, or in the operation of any internal combustion engine. In other respects, controls on the production and distribution of liquid pumps as established in the original Order issued on April 12, remain unchanged.

RESINS AND MOLDING COMPOUNDS

Allocation Order M-331 was issued by WPB on June 16 to direct the distribution of urea and melamine aldehyde resin and molding compounds from suppliers to manufacturers of molded parts, resin bonded shapes or forms, and protective coatings. As of July 1, delivery and use of these compounds must be authorized specifically by the WPB in writing. The usual chemicals allocation Forms PD-600 and PD-601 must be used.

One exception to the Order provides that specific authorization is not required for the delivery or use from all sources in any one month of not more than 1,000 lb. of urea or melamine aldehyde resin and not more than 100 lb. of urea and melamine aldehyde molding compound. Another exemption permits the delivery and use of not more than 55 gal. of urea or melamine aldehyde resin or molding compound over and above the specifically authorized quantity when it is required for experimental purposes.

SODIUM PHOSPHATES

General Preference Order M-334 was issued by WPB on June 16, placing new restrictions on the delivery and use of sodium phosphates. Up to 1,000 lb. of any sodium phosphate may be delivered by a producer or primary distributor without authorization to any person in any one month. Over 1,000 lb. and up to 10,000 lb. of any sodium phosphate may be delivered and used without specific authorization provided that the customer certifies that his total receipts of sodium phosphate for any one month will not exceed 10,000 lb. The customer must also certify the uses to which the sodium phosphate will be put. Producers and the primary distributors of sodium phosphates who require authorization to deliver during any calendar month, beginning with August, 1943, must make application on Form PD-602. Any person (not including Army, Navy or Government Agencies) who, for any month, has a requirement for more than 10,000 lb. of any sodium phosphate must make application to WPB on Form PD-600. This application for authorization may be discontinued in any month if the person's requirements fall below 10,000 lb.

GLYCOL ETHERS

Allocation Order M-336, issued on June 22 by WPB, placed glycol ethers under allocation as of July 1. "Glycol Ether" means the monobutyl ether of ethylene glycol or the monoethyl ether of diethylene glycol. The exception for small deliveries provides that specific authorization is not required for the delivery by a supplier to any person in any one month of not more than 400 lb. of monobutyl ether of ethylene glycol, or not more than 460 lb. of monoethyl ether of diethylene glycol. The total volume for small deliveries by any supplier must not be in excess of 5 percent of the total quantity of each of such materials which he has been specifically authorized or directed to deliver during the month. Persons requiring more than is permitted in the small delivery exceptions must make application on Form PD-600, filled out in accordance with special instructions included in the Order. Suppliers who require authorization to make deliveries must file Form PD-602 in accordance with instructions included in the Order.

ETHYL AND ISOPROPYL ACETATES

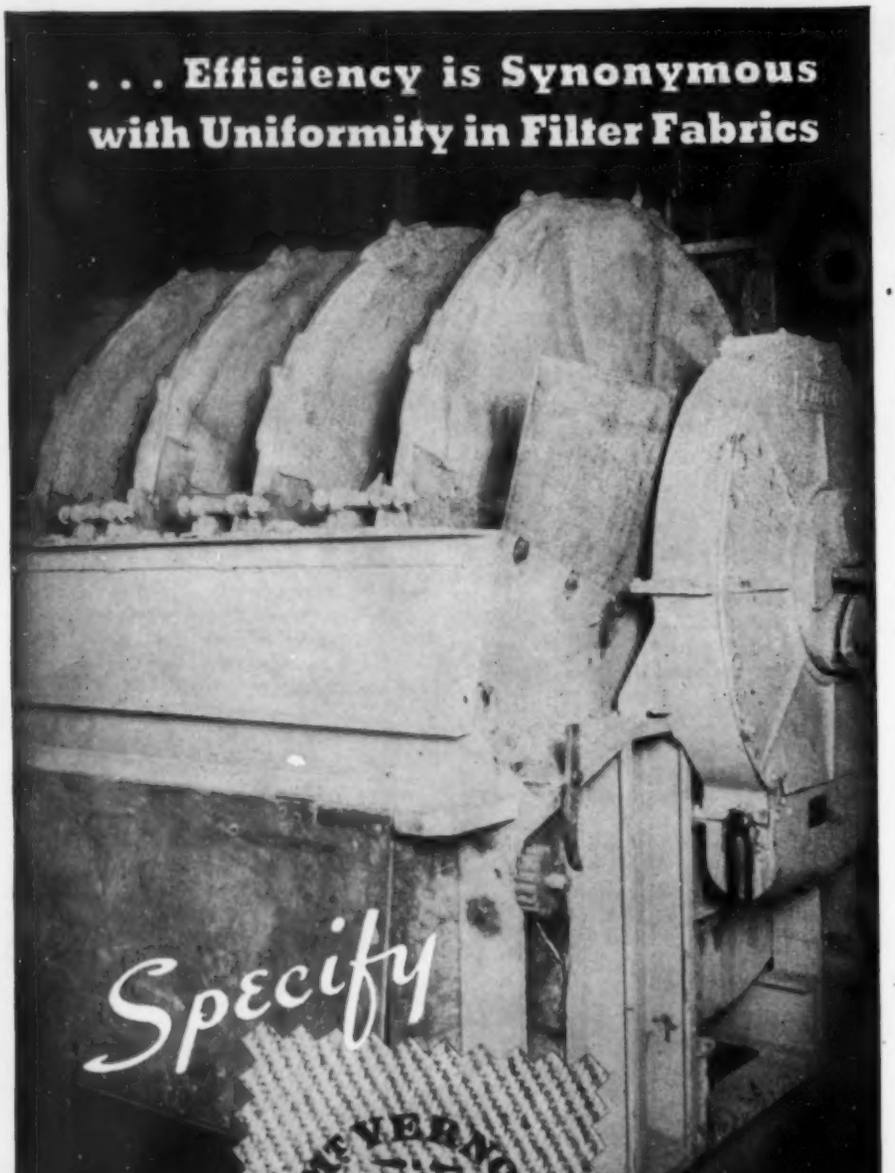
General Preference Order M-327 was issued by WPB on June 7, placing under allocation both ethyl acetate and isopropyl acetate. Delivery and use by any person in any one calendar month of not more than 54 gal. of either compound is exempted from allocation control. For delivery or use of larger quantities, the regular chemicals allocation Forms PD-600 and PD-601 must be used.

CELLULOSE ESTERS

Allocation Order M-326 was issued on June 8 by WPB to control cellulose ester flake. To control the end use of cellulose ester flake in plastics, Supplementary Allocation Order M-326-a was issued to govern molding powder, sheets, rods and tubes in primary form produced from cellulose ester flake. Exemption from the required WPB authorization includes 100 lb. or less of cellulose ester flake in the aggregate, 100 lb. or less of cellulose plastic molding powder, 50 lb. or less of cellulose plastic sheets, 50 lb. or less of cellulose plastic rods, and 50 lb. or less of cellulose plastic tubes in any one month. Neither cellulose nitrate nor ethyl cellulose are covered by these Orders. Order M-326 requires the use of allocation Forms PD-600 and PD-601, whereas Order M-326-a requires the use of Form PD-602 by producers and distributors only. Issuance of these two Orders does not change the restrictions previously applied by WPB Orders L-20, Cellophane; L-233, photographic film and film-base, and M-154, as amended, Thermoplastics.

CASEIN

General Preference Order M-307 was amended by WPB on June 8, making it necessary for suppliers of casein to file separate Forms PD-601 for proposed deliveries to each type of customer. For the purposes of such requirements, the classes of primary products are listed as



WHERE ever you find a high degree of efficiency in filtering operations and fabrics are the filtering media, there you will find a high degree of fabric uniformity for once the proper fabric construction has been determined then filtering efficiency and fabric uniformity go hand in hand. That is why from the selection of top grades of cotton to their last final inspection, we exert such eternal vigilance in the production of MT. VERNON Extra filter fabrics. That is why day by day we continue to add to our more than fifty years industrial fabric making experience by endeavoring to make MT. VERNON Extra filter fabrics better, stronger and more highly uniform than ever before.

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adhesives, coated paper (except wallpaper), gypsum, insecticides, leather finishes, plastics, rubber, wallpaper, other products (specify), resale (as casein) or inventory (as casein). Customers will continue to apply on Form PD-600 for authorization to accept or to use casein in any calendar quarter.

STABILIZED ROSIN

General Preference Order M-335, issued June 30 by WPB, placed stabilized rosin under allocation. Its use in soap is prohibited except when made for non-detergent purposes such as textile processing. Stabilized rosin is defined as rosin which has been stabilized by hydrogenation, dehydrogenation, or disproportionation, but not polymerization or condensation.

LEAD

General Inventory Order M-161, Schedule A, was amended on June 28 by WPB to facilitate the movement of lead over the crowded transportation lines during months of light traffic. The Order waives inventory restrictions on lead so that this material may be moved into consumer channels in larger quantities.

WOOD PULP

General Preference Order M-93 was amended on June 29 to give WPB complete control over the use of all grades of wood pulp. Previously, Supplementary Order M-93-a had been issued to require the withholding of pulp for delivery as directed by WPB.

CALCIUM CARBIDE

General Preference Order M-190 was amended on June 15 by WPB, eliminating the necessity of certification for the delivery of not more than ten tons of calcium carbide in any one month. The amended Order also provides that no person who is required to obtain specific authorization to receive or use calcium carbide for the generation of acetylene, shall accept or fill any order for acetylene for a purpose other than welding or cutting, unless the person placing the order shall have furnished him, or shall have filed with the WPB, Chemicals Division, Washington, D. C., a certificate showing the amount required, primary product and use.

CHLORATE CHEMICALS

General Preference Order M-171 was amended on June 7 by WPB to change allocations of chlorate chemicals from a monthly to a quarterly basis. Chlorate chemicals as defined in the Order include potassium chlorate, sodium chlorate, barium chlorate, potassium perchlorate, ammonium perchlorate, perchloric acid and any other chlorate or perchlorate chemicals. The amendment provides that producers and distributors of chlorate chemicals shall use Form PD-602 in making application for allocation. Customers need not file any forms with WPB, but must give certificates to their suppliers.

Specific authorization by WPB is not required for delivery of not more than 25 lb. of any chlorate chemical in the

calendar quarter. In preparing Form PD-602, producers or distributors may lump together into an aggregate amount any orders which call for 250 lb. or less for each use.

GLYCOLS

Limitation Order M-215 was amended on June 25 to provide that any person may accept delivery of and may use the following quantities of any two kinds of the following glycols in any month without specific authorization of WPB, provided such glycols are not used by such person or supplier for automotive antifreeze or motor coolant use: ethylene glycol, 5,000 lb. or less; propylene glycol, 950 lb. or less; diethylene glycol, 1000 lb. of less; triethylene glycol, 250 lb. or less; mixed glycols, 250 lb. or less. However, suppliers filling these small orders must not permit the aggregate of these orders to exceed two percent in the case of ethylene glycol, six percent for propylene glycol, six percent for diethylene glycol, one percent for triethylene glycol, and one percent for mixed glycols.

LEATHER

Conservation Order M-310, issued by WPB on June 24, consolidates ten Orders under which the WPB conserves supply and directs distribution of hides, skin and leather. The orders involved are: M-80, M-80-1, M-94, M-114, M-114-b, M-141, M-141-d, M-194, M-273, and M-301.

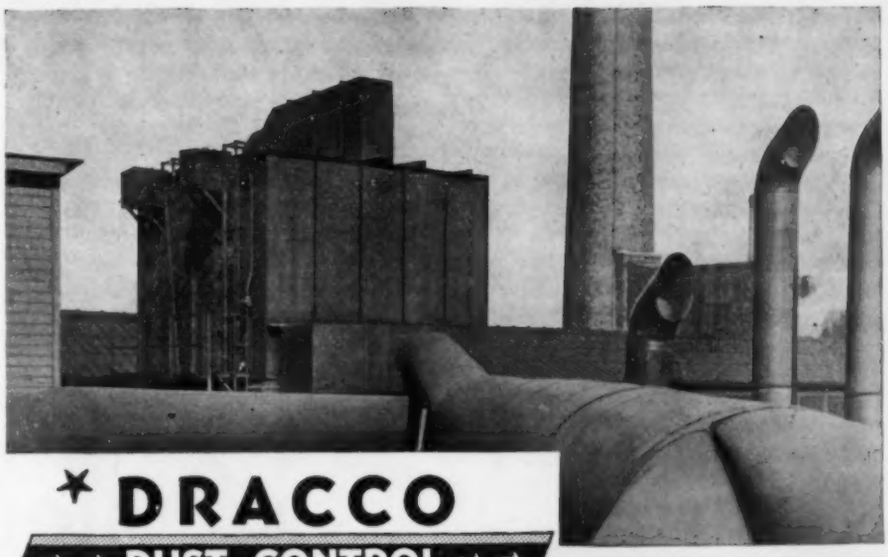
MAXIMUM PRICE REGULATIONS

MPR-37, Amendment No. 5, effective July 1, permits producers of **butyl alcohol made from grain** to deliver at the price in effect at the time of delivery, subject to upward adjustment in accordance with any action that may be taken by OPA to adjust ceiling prices in the event that grain costs rise above the levels anticipated when alcohol ceilings were set.

MPR-114, amendment No. 7, issued on June 22, and effective June 28, provides that producers of **sulphate wood pulp** for shipment pursuant to allocation by the War Production Board and produced with drying equipment not designed for the production of this pulp for sale on the open market, may obtain maximum prices for these particular shipments, higher than those prevailing ceilings for usual sulphate wood pulp sales. Such producers must file with the OPA for approval, their proposed maximum price ceiling.

MPR-180, amendment No. 1, issued on June 25, by OPA exempts **red lead** and **orange mineral color** pigments from the regulation. Although the original definition of color pigment was broad enough to include these two products, they are not produced by the manufacturers who produce the pigments intended to be covered by the measure. They will continue to be priced under the General Maximum Price Regulation until a separate regulation on lead pigment paint is issued.

MPR 403 was issued on June 3 by OPA to regulate maximum prices for most important **rubber commodities**

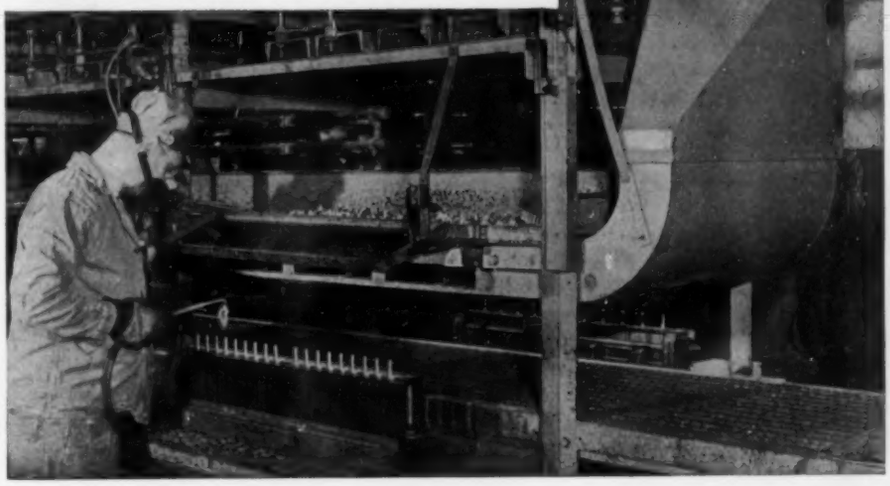


* DRACCO

DUST CONTROL

FOR THE

WILLARD STORAGE BATTERY PLANT



Lead dust is particularly serious in the manufacture of batteries because of the large volume of lead used. The Willard Storage Battery Company installed DRACCO Bag Type Arresters in the fall of 1942 which have established a record of high dust collecting efficiency. The equipment is used 16 hours a day, 6 days a week, with air removal at 24,000 cubic feet per minute. The lower photo shows employees burning straps to groups of plates. The plate burning table and grating top conveyor are exhausted by DRACCO Filters. Respirators are used as an added precaution.

• *For Further Information write* •

DRACCO CORPORATION

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PNEUMATIC CONVEYORS • DUST COLLECTORS

What do *YOU* know *about* Tetrahydrofurfuryl ALCOHOL

Are you depending on a few sketchy sentences relating to this product? AVAILABLE in moderate quantities without priority, you should have first hand knowledge of its ability to do a job for you.

Tetrahydrofurfuryl Alcohol is a solvent for chlorinated rubber, nitrocellulose, vinyl resin, and certain difficultly soluble dyes and stains. Certain of its esters and ethers have excellent plasticizing properties. Recently substantial quantities have been used as a solvent and plasticizer in the manufacture and use of polyvinyl butyral coated fabrics. You should have firsthand knowledge of this chemical which has the following typical properties:

Specific gravity (25/25) 1.052
Boiling range (99%) .....170-180°
Flash point .....75-80°C.
Refractive index (25/D) 1.4502
Color .....Virtually water white

If you have need for a solvent as capable as Tetrahydrofurfuryl Alcohol, let us know. Inquiries regarding specific applications are welcome.

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... TETRAHYDROFURFURYL ALCOHOL ...

bought for government use. Establishing April, 1943, as the base date, the regulation gives the pricing method for manufacturers to apply to goods that are the same or similar to those sold or offered for sale in the base period, and also to goods that are different from those sold in the base period. Other sellers than manufacturers are to establish their maximum prices by applying mark-ups to their purchase prices for the commodities. Upon application to OPA, approval will be given for maximum prices for those commodities which cannot be priced under the specified methods. Pending the OPA's approval, the commodities concerned are free from price control for a period of three months. Maximum prices covered by this regulation were established formerly under one or another of four other regulations now superseded; the General Maximum Price Regulation, and Maximum Price Regulations 157, 149 and 220.

MPR-404, issued by OPA on June 12, places under specific dollars-and-cents ceilings all sales by **domestic producers of potash.** Prices remain at levels prevalent since 1937, where they were frozen by the General Maximum Price Regulation over a year ago. Prices for sale of imported potash to fertilizer manufacturers have been rolled back to bring them in line with potash produced in the United States. All price ceilings fixed by this latest regulation are subject to a seasonal discount of 12 percent in order to encourage fertilizer manufacturers to take delivery of potash as it is produced, uniformly throughout the year, instead of asking for full delivery immediately preceding the fertilizer mixing season.

MPR-406, issued by OPA on June 16, provides specialized price control for 19 main classes of **resins** and **plastic materials.** Among the most important of these groups are phenolic resins, cellulose ethers and esters, alkyd resins, and acrylate resins, when they are in the form of base solutions, laminates, molding powders, sheets, rods or tubes. Most of the plastics covered by the regulation are used in the production of parts for airplanes, electrical equipment, radios and consumer durable articles. The bulk of the resins is sold for use in the manufacture of paints and varnishes.

Custom made plastic parts or objects, read-to-be-applied protective coatings, synthetic fibers and synthetic rubbers are specifically excluded from the regulation. The new regulation replaces the General Maximum Price Regulation for pricing these materials. Simple methods are provided for pricing the many thousands of new products which are developed by the industry: The pricing formulas will result in prices which generally reflect March, 1942 prices.

MPR-411, issued on June 26 by OPA, provides specific maximum prices for **reusable steel storage tanks,** field assembled. For steel bolted storage tanks dollars-and-cents prices "per tank" are provided for those of various capacities. For steel riveted and welded tanks, dollars-and-cents "per ton" prices are es-

tablished. In the case of steel storage tanks with floating or balloon roofs and steel tanks of spherical shapes, sellers are given a procedure for submitting a proposed price to OPA for approval. Previously, reusable tanks were priced under the General Maximum Price Regulation, which provided that ceilings should be the highest prices individual sellers charged during the month of March 1942. The new regulation became effective July 2, 1943.

Equipment not covered by this maximum price regulation includes (1) reusable shop-assembled tanks, (2) reusable steel storage tanks (field-assembled) purchased for the Lend Lease administration, (3) reusable structural steel plate, (4) reusable steel sheets, (5) re-erected reusable steel storage tanks and services of dismantling and re-erection under contract.

MPR-412, issued on June 23 by OPA, provides dollars-and-cents maximum prices for **tidewater red cypress** lumber. The new ceiling prices are based on manufacturers' list prices in effect March, 1942, plus an allowance of $1 per M.B.M. to compensate producers for the elimination of price gain formerly enjoyed in selling on an F.O.B. Perry, Fla. basing point system. Provision is also made permitting an addition to the established maximum prices of $1.50 per M.B.M. by producers in the State of Louisiana, to compensate for an average gain of this amount which they had customarily enjoyed over the average realization of eastern producers.

MPR-416, issued June 28 by OPA, provides specific dollars-and-cents prices for **basic refractory** brick, dead-burned dolomite, dead-burned grain magnesite and similar basic refractory products used in the masonry linings of metallurgical and industrial furnaces. Price levels, which have not changed significantly since September and October, 1941, are not altered by this action which replaces the "freeze" action previously controlling these materials.

Revised Supplementary Regulation 1, amendment 12, was issued on June 7 by OPA to facilitate the production of **steel valves** for sale to government agencies for use in the war effort. The amendment exempts from price control steel valves, valve parts, and sub-assemblies, as well as any operation performed in the processing, machining, welding, treating or finishing of these products when sold or performed by new sub-contractors to and for valve manufacturers under contract with the Navy Department for these articles. This exemption will not apply to sub-contractors producing or servicing these products prior to the effective date of the amendment, June 7, for valve manufacturers having this contract with the Navy Department. They already have been operating under price ceiling regulations and will continue to do so. The purpose of the amendment is to prevent delay in bringing new producers and service suppliers into this field, even though the costs of these new producers and suppliers cannot be determined at this time.

COUNTERBALANCED
Regulation
GIVES PERFECT SEPARATION

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AIR CURRENTS

RESULT:

Amazing accuracy in selecting fines

Everyone knows the "principle" of air separation. It's just the utilization of centrifugal force and air currents. Anyone can build a machine to operate that way. The principle is simple . . . but it took STURTEVANT 20 years to *work it out perfectly!* The efficiency of STURTEVANT Air Separators (in plain words, whether you get products of the exact fineness you desire and reject—all coarser sizes)—depends on the PROPER COUNTERBALANCE of the centrifugal force and air currents, and their regulation by simple adjustments.

That, in turn, is based on a thorough knowledge of the various combinations of peculiarities of materials, circulating loads and the types of pulverizers with which you work. Sturtevant Engineers are not only Air Separation experts but PULVERIZER experts as well. We've built and operated most types of Pulverizers for 38 years—Separators for over 20 years. Is it any wonder then, that once a mill or process plant buys a Sturtevant Separator it buys Sturtevant again REPEATEDLY and will take no other? Write and let us tell you details of this perfected Air Separator.

Ask for Bulletin 087

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Increases mill capacity 25 to 300%

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Range; 40 to 400 mesh

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Lowers power consumption 10 to 50%

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CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
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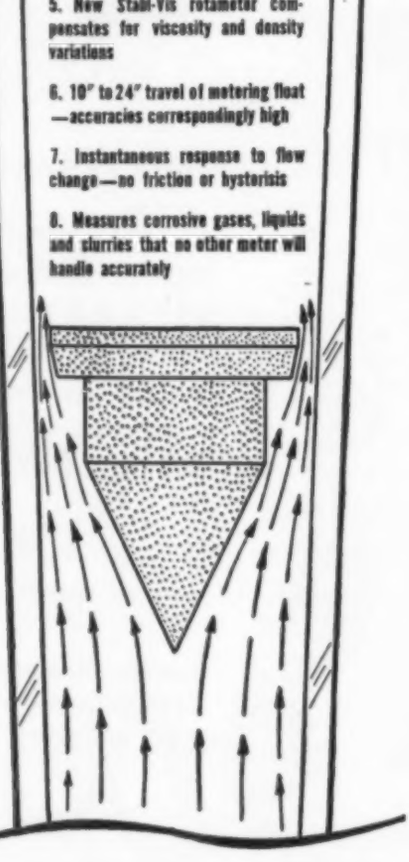
The ROTAMETER

has these advantages over head-type meters for flow rate measurement and control

8 BASIC ADVANTAGES

1. Metering elements and fluid being metered clearly visible
2. Wide flow range—20-to-1 easily obtained
3. Evenly spaced scale divisions—no compression of scale at low flows
4. Low, constant pressure drop—reduces pumping costs
5. New Stabil-Vis rotameter compensates for viscosity and density variations
6. 10" to 24" travel of metering float—accuracies correspondingly high
7. Instantaneous response to flow change—no friction or hysterisis
8. Measures corrosive gases, liquids and slurries that no other meter will handle accurately



DURING the last two years a definite reversal of trend in the development of meters for rate of flow measurement has become noticeable in industry. The area-type flow meter, in the form of the rotameter sight flow meter, has steadily and surely elbowed its way to the front. Already it has completely replaced the head-type meters (orifices, flow nozzles, venturis, weirs, capillaries) for many important applications and the process of replacement is still going on.

The inherent theoretical advantages of the area-type flow meter have always been recognized, and equally obvious were the several limitations of the head-type meter. Yet for a long time the area-type meter was mainly a curiosity, used only for unusually difficult applications. Not until Fischer & Porter Company in 1937 announced the availability of precision-bore, interchangeable transparent metering tubes for rotameter sight flow meters, did the area meter start to progress.

In Toricelli's equation $Q = CA\sqrt{2gh}$, the area-type meter (rotameter) obtains measurement by varying the value of "A" (area of flow passage) whereas head meters vary the value of "h" (head producing flow). Thus the rotameter "gets out from under the square-root sign," which results in a linear calibration scale instead of a square root scale crowded at the lower end. The range of flows which can be accurately metered with the rotameter is thereby tremendously increased.

Furthermore, the visibility in the rotameter of the fluid being metered and of the metering elements eliminates errors due to fouling or corrosion. Likewise, the pressure drop through the rotameter is low and constant because the flow area enlarges as the float rises in the tapered tube with flow increase. Thus the rotameter may be used where low initial pressures only are available, and at all times the rotameter reduces the pressure required to pump fluids through the lines. In remote recording and controlling rotameters, another outstanding advantage is the ability to visually check the readings of the primary instrument against the readings of the secondary instrument while in operation.

Possibly you have used the rotameter sparingly, or not at all, because you have not realized its basic worth. The further one delves into the details of the rotameter functioning, the more advantages come to light. Modern instrumentation is characterized by an acknowledgment of these advantages through the increasing use of the rotameter for flow rate measurement and control. Our bulletin #10-A entitled "A New Trend in Flow Rate Measurement" describes the rotameter clearly and concisely. It contains free, valuable information — why not write for it? We will gladly send it to you without any obligation whatsoever.

FISCHER & PORTER CO.
187 County Line Road, Hatboro, Pa.

FISCHER & PORTER CO.

F&P ROTAMETER

RATE OF FLOW INDICATING, RECORDING OR CONTROLLING ROTAMETERS FOR ANY LIQUID OR GAS

NEW PRODUCTS AND MATERIALS

CONTENTS

Synthetic Rubber Sponge..... 155
Sponge Rubber From Resin..... 155
Lignin Plastic From Farm Wastes.... 155
Cement That Rivals Welding..... 155
Plastic Substitute For Rubber..... 155
Synthetic Rubber Compound..... 156
Diphenylamine Purifies Cellulose.... 156
Waxes 156
Synthetic Rubber For Hose..... 157
Dehydrated Sugar 157
Sulphamerazine 157
Corrosion Resisting Coating..... 157
Plasticizer 158
Cleaner 158
Protective Cream 158
Esters 158
Hydroabietyl Alcohol 159
Synthetic Perfumes 159
Synthetic Rubber Reodorants..... 159
Surface-active Agents 159
Camouflage Paint 160
Paint-like Plastic 160
Yellow Fluorescent 160
Fatty Acids From Animal Fat..... 161
Waterproof Sealing Tape..... 161
Base For Liquid Soap..... 161
Eradicator For Poisonous Weeds.... 162
Synthetic Biotin 162
Heat Insulation 162

SYNTHETIC RUBBER SPONGE

A synthetic rubber sponge which will remain soft and compressible at —40 deg. F. has been developed by B. F. Goodrich Co. Of medium density, the new sponge is black and can be furnished in slabs or molded shapes. It has the same resistance to oils, greases, chemicals and oxidation possessed by all Koroseal products. It can be made in various densities and pore sizes.

Non-flammability characteristics of Koroseal sponge made from plasticized polyvinyl chloride are observed by Dr. Frank Schoenfeld of B. F. Goodrich Co.

SPONGE RUBBER FROM RESIN

Waterproof, resilient, non-flammable, and sound-proof, Plastic Foam is a wartime replacement for Airfoam, the sponge rubber derived from spun latex and formerly used as an insulating material and wing-filler on military airplanes. This new plastic insulation material made from resin, closely resembles packed snow and is said to be superior to natural rubber in many respects.

The Goodyear Tire & Rubber Co., Akron, Ohio, is making Plastic Foam in two types, a plain type and an impregnated type. The plain type is reenforced with cheese cloth or other fabric, but is sufficiently strong to be handled freely although it is somewhat susceptible to shock. The impregnated material's resilience is increased and fragility decreased by adding a flexible substance.

Made from resin and superior to rubber in many respects for the same uses, this slab of plastic insulation material is Goodyear's Plastic Foam

LIGNIN PLASTIC FROM FARM WASTES

From farm wastes come a lignin plastic which may be used as a replacement for metal for many purposes. Engineers at Northern Regional Research Laboratory, Peoria, Ill., where the research is being conducted, state that this thermosetting plastic can be made from corn stalks, wheat straw, flax shives and other fibrous materials, and that it can be made with one-half the phenol-formaldehye resin commonly required in manufacture of this type of plastic. This is not a plastic using either isolated or reinforced lignin, but is a plastic of high lignin containing the annual fiber. The announcement is made at this time so that manufacturers of military supplies may use the process in the production of critical materials. Physical properties of this new lignin plastic are similar to those that use the higher percentages of phenol-formaldehyde. It has been found to mold satisfactorily in standard automatic molding machines.

CEMENT THAT RIVALS WELDING

Perfection of a new process that will stick airplane wings and other structural parts more firmly together than they can now be rivetted or spot welded has been announced by Goodyear Tire & Rubber Co., Akron, Ohio. It is known as Cycleweld adhesive process and is a joint venture of Goodyear and Chrysler Motor Corp. The process has two types of application. One is to bond vulcanized or synthetic rubber to metals or plastic. The other is to bond metal to metal, wood or plastic. In both cases the process is essentially the same and depends upon use of newly developed cement. The proper cement is applied to the surfaces to be bonded together and then "cured" in a furnace under heat and pressure. In the case of the metal-to-metal bond, cement has been developed in the form of a film or cake. The process in the bonding of metal to metal lends itself particularly to the bonding of light alloy parts. In this use the cycle-welding is a direct competitor of riveting and spot welding, in comparison of which it is reported to show superior strength under static load and in resistance to vibrational stresses. In every use of cycle-welding, whether metal is to be bonded to metal or synthetic rubber to a plastic, or whatever the case may be, the result is a bond stronger than the materials bonded together.

PLASTIC SUBSTITUTE FOR RUBBER

Development of a plastic that can be vulcanized like rubber and therefore serve as a substitute for rubber in a wide variety of shapes has been announced by Goodyear Tire & Rubber Co., Akron, Ohio. Plioflex is said to be superior to the numerous plastics now being tried as rubber substitutes. Tensile strength of Plioflex can be improved 100 to 200 percent during vulcanization. It can be compounded with a large number of substitutes just as is natural rubber in order to arrive at different characteristics of the many products. Goodyear has succeeded in preparing one type of Plioflex that has excellent flexing characteristics, good physical properties, and can be chilled to —50 deg. F., without becoming brittle.

A GENERAL PURPOSE COLD-APPLIED THERMOPLASTIC COATING FOR A WIDE RANGE OF APPLICATIONS

Amercoat No. 33 Thermoplastic Coating is the result of two years of careful development and exhaustive test both in the laboratory and in the field. It meets the urgent demand for an inert, easy-to-apply protective coating for wood, metal and concrete.

Amercoat No. 33 is used as a coating for structural steel, floors, filters, tanks, concrete walls and floors, machinery, ship bottoms and boottopping, concrete urinals, shower bases, laundry tubs... wherever buildings and equipment are exposed to corrosive fumes or the corrosive action of salt water, fresh water or various mild acids or caustics.

Amercoat No. 33 Thermoplastic Coating is composed of the correct combination of the most inert synthetic resins obtainable. It comes in liquid form and is easily applied with ordinary industrial paint spray equipment or by brush. It may be applied in any number of coats required for any particular condition. It is odorless, tasteless, resistant to moderate abrasion and is dielectric to a high degree.

***Amercoat* No. 33 does not replace, nor is it a substitute for other *Amercoat* Compounds which have been developed for more highly specialized requirements.**

Amercoat DIVISION

Write for Bulletin No. 33 which gives complete data on AMERCOAT No. 33 and the many uses for which it is suited.

AMERICAN PIPE & CONSTRUCTION COMPANY
P.O. BOX 3428, TERMINAL ANNEX • LOS ANGELES, CALIF.
Canadian Dist: Gunite & Waterproofing, Ltd., 1538 Sherbrooke St., W., Montreal

SYNTHETIC RUBBER COMPOUND

Development of a compound made from Ameripol which will remain so flexible at —70 deg. F. that it can be bent at an angle of 90 deg. around a ½-inch rod, is announced by B. F. Goodrich Co., Akron, Ohio. The compound is being used in the construction of bolted tanks for storage of high-octane gasoline and aromatic fuels. In the construction of these tanks, made from sheet metal, sealing strips of the synthetic rubber 1¾ in. thick are placed at the points where the sheets are bolted together. Half inch bolts are used to squeeze the synthetic rubber tightly between the plates, assuring a perfect fuel-tight seal that is highly solvent resistant.

DIPHENYLAMINE PURIFIES NITROCELLULOSE

When working on the development of a process for the production of smokeless powder, Dr. Fred Olsen, technical director of Western Cartridge Co., carried out a series of experiments to find a dye other than rust that is "fast" to nitrocellulose, and could be bound closer to the nitrocellulose than the acid impurities which he was attempting to remove. He discovered that dyes which gave the most satisfactory results belong to the amines group. He found that diphenylamine gave perfect results. This material had always been used as a partial "curative" in the conventional production of smokeless powder. However, it had never before been used as a "preventive medicina" in the early stage of manufacture to permeate or dye the nitrocellulose when it was wet and when it could literally chase the acid impurities out of the cellulose fibers and into the surrounding water where they were easily neutralized. Since the purification process occurs in water, it reduces the hazard of powder making to a minimum. This development led to the making of smokeless ball powder which was described in *Chem. & Met.* pages 206-207, May, 1943.

WAXES

It is reported that the Glidden Co., Cleveland, Ohio, has announced its interest in two natural products that may hold post-war significance: (1) the jojoba nut from a desert bush that has been cultivated successfully in recent experiments, and (2) mycrene, a product of turpentine distilling from which a rubberlike material is processed for surgical adhesive dressing, according to *Business Week*. The jojoba nut yields a liquid wax better for its purposes than carnauba wax. In addition to its use in varnish, floor wax, and other formulations, the nut is a possible source of a natural rubber especially resistant to acids and alkalis.

To produce mycrene which would not compete with natural rubber, Nelio Resin Co., of Jacksonville, Fla., a Glidden subsidiary, will build a fractionating still in connection with one of its turpentine refineries. The adhesive made from mycrene has the usual quality of sticking to the skin, but not to a wound. Its manufacture may help to sustain a strong demand for turpentine after the war.

SYNTHETIC RUBBER FOR HOSE

It is reported that a new synthetic rubber has been developed by Hycar Chemical Co., for flexible hose and other aircraft parts. Known as Hycar OR-25, the new synthetic permits successful and proper operation of these parts at extremely low temperatures. It has been thoroughly tested to meet specifications for flexibility, oil resistance and other essential qualities at extremely low temperatures and its use extends to all flexible plane parts which include fuel and oil hose, coolant hose, hydraulic hose and accumulator bags, carburetor diaphragms, fuel gages and valves.

DEHYDRATED SUGAR

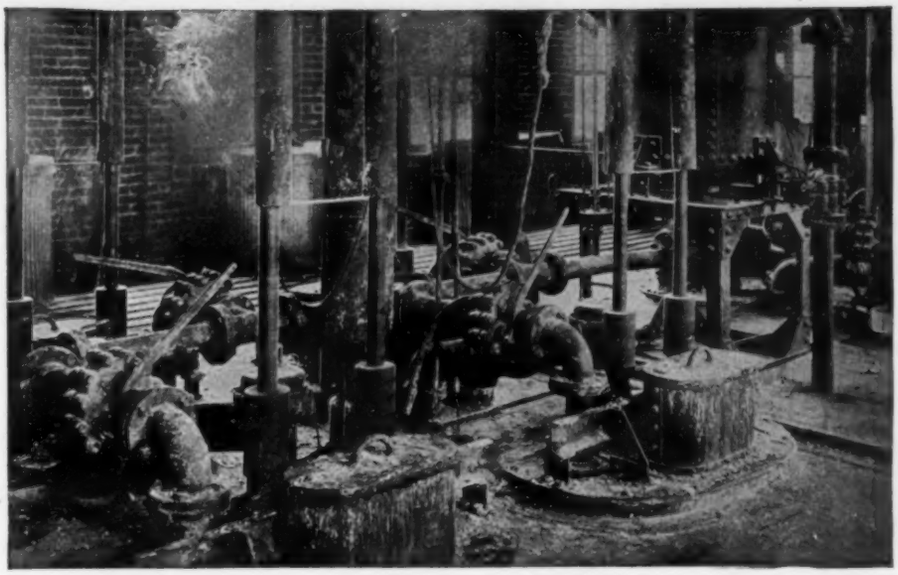
A new dehydrated cane sugar, named Vital Sugar, developed by Dr. Royal Lee of the Lee Foundation for Nutritional Research and to be marketed by Vitamin Products Co., Milwaukee, is reported by *Business Week*. It is said to contain all the natural vitamins and minerals of the original sugar cane. The manufacturing process consists of (1) expressing juice from the cane; (2) filtering; (3) sterilizing with a solvent which evaporates completely; (4) freezing the juice, which results in the formation of ice crystals of practically pure water intermingled with a concentrated solution of sucrose, minerals, and so on; (5) extracting concentrate by centrifuging; (6) adding a little grain extract (wheat, flax, barley) to render the final sugar less hydroscopic; (7) drying to crystal or powder form by standard equipment used in milk or egg drying. The end product is a cream-colored, sweet-tasting substance differing from other sugar in that it has a tartness found in very sweet orange juice. It is reported that the yield of the new sugar from cane juice is about double that of standard refinery practice. There is no molasses as a byproduct.

SULPHAMERAZINE

Sharpe & Dohme, Philadelphia, Pa., has developed sulphamerazine. The new drug is said to be less expensive to make than sulphadiazine and equally efficient in smaller dosages.

CORROSION RESISTING COATING MATERIAL

Here is a surface coating material that is said to stand up under the action of acids, alkalis, oils, gasoline, alcohols, etc., where other protective coatings have failed because it is compounded with special formulations of new and improved synthetic resins. Ucilon made by United Chromium, New York, N. Y., is air-drying and may be applied by the conventional methods of brushing, spraying or dipping. The average coverage of Ucilon varies from 350 to 800 sq. ft. per gal. per single coat, depending upon its color and the surface coated. Three or more coats are generally recommended, the number being determined by the severity of the service conditions. Although air drying at room temperature is satisfactory for many applications, force drying at temperatures up to 250



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TYPICAL SERVICES WHERE EVERLASTING VALVES EXCEL . . .

- Outlets of storage and measuring tanks
- Throttles of hammers and hoists
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- Washers for laundries, cleaners and dryers
- Spray lines to rolls
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- Suitable for acids, alkalies, caustics, cellulose, coal tar, emulsions, syrups, and other liquids; also gases and vapors

This completely distinctive and unique design has a drop-tight seal which assures leak-proof closure; and the disc has a rotating, self-grinding action on the seat at each movement, which *maintains* tightness indefinitely.

Enthusiastic users report that Everlasting Valves flow fluids faster, give better service, and last longer than other designs on process lines, emergency shut-offs, equipment outlets, boiler blow-off and similar services.

The many important and exclusive advantages of this design are described in bulletin which will be sent on request.

Built in sizes from ¼-in. to 6-in., in cast iron, bronze and cast steel, and with a range of sizes for 250-lb., 350-lb., and 600-lb. pressures. Furnished with straight lever as shown in view of valve, or with rack and pinion as shown in photograph of installation.

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Everlasting Valves

for everlasting protection

HAVEG

Corrosion Resistant Equipment

NON-metallic. Corrosion Resistant throughout its entire mass. Unaffected by rapid temperature changes. Can be used continuously at temperatures as high as 265° F. Seamless one piece units as large as 10 feet in diameter by 12 feet in depth. Tanks, Towers, Pipe and Fittings, Valves, Pumps, Fume Duct—available in standard sizes.

HAVEG 41

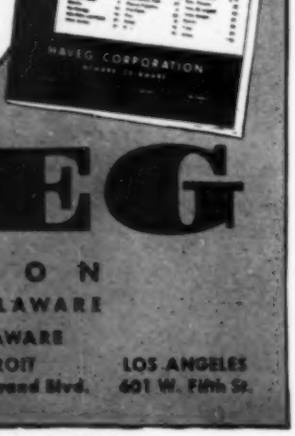
The basic standard grade of HAVEG. It is highly resistant to most acids, salts, the weaker bases, and many solvents. It is tough and strong, resists blows and shocks exceptionally well, and is unaffected by thermal shock or sustained temperatures up to 265° F. (130° C.)

HAVEG 43

A grade developed for use with hydrofluoric acid and related compounds. While it is less resistant to shock than HAVEG 41 it is well able to withstand ordinary conditions of abuse.

HAVEG 50

An alkali resistant grade. Has effective resistance to even hot concentrated alkali solutions such as sodium hydroxide and potassium hydroxide. It is also resistant to most inorganic acids. HAVEG 50 will withstand considerable physical shock.



Write for Bulletin F-3

This bulletin gives complete chemical, mechanical and constructional data on all types of standard and special HAVEG equipment: Tanks, Towers, Pipe and Fittings, Valves, Pumps, Trays, and many other items are all fully illustrated with photographs or drawings.

HAVEG

CORPORATION

NEWARK DELAWARE

FACTORY—MARSHALLTON, DELAWARE

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deg. F. is necessary to develop the maximum adherence and the greatest possible protection against corrosion.

PLASTICIZER

Polyvinyl butyral can be cured with a combination plasticizing and curing agent developed by Glyco Products Co., Brooklyn, N. Y. Polyset No. 35 needs no additional plasticizer and requires no change in the usual method of processing. It can be easily calendered, extruded, cement-spread or press molded. It cures by heat, becoming permanently thermosetting and solvent insoluble with a marked increase in tensile strength.

CLEANER

An all-purpose cleaner which, it is claimed, reduces the need for rubbing and scrubbing has been announced by National Laboratories, Toledo, Ohio. It is said to be a concentrated compound containing no abrasives. It is available in 55-gal. returnable steel drums.

PROTECTIVE CREAM

A skin protective cream known as Pro-Tek-Tor No. 6 for use by workers having contact with cutters and lubricating oils, kerosene, petroleum, solvents, thinners, lacquers, paint, ink, etc., has been developed by Nielco Chemical Co., Redford Station, Detroit, Mich.

ESTERS

Poly-pale esters No. 1 and 2, are, respectively, the ethylene and diethylene glycol esters of Poly-pale resin and generally similar in their properties to Flexalyn and Flexalyn C, and to the Staybelite esters No. 1 and 2. They were developed by Hercules Powder Co., Wilmington, Del. They are widely soluble and compatible, show a low rate of oxygen absorption, and are harder and higher melting than the corresponding glycol esters of rosin or Staybelite. Like most rosin derivatives, the Poly-pale esters may be used with water-dispersible, film-formers such as casein, starch, animal glue, methyl cellulose, gelatin, etc., to give increased adhesion, toughness, resistance to shock, water sensitivity, etc. They may be applied in molten form, from solvent solution or from aqueous dispersion.

HYDROABIETYL ALCOHOL

As its most recent contribution to the field of chemical products derived from waste pine stumps, Hercules Powder Co., Wilmington, Del., announces the limited production of hydroabietyl alcohol. This material is prepared from rosin as a starting material and may be described as the alcohol comparable to abietic acid. The alcohol consists of a mixture of several closely related alcohols which possess a basic nuclear structure similar to that of abietic acid. Technically, it consists chiefly of dihydroabietyl alcohol, but also contains dehydroabietyl, tetrahydroabietyl, and ordinary abietyl alcohols. In all of these

compounds, the primary alcohol group is present in place of the carboxyl group which latter characterizes abietic acid and similar resin acids. Its pale color and resistance to discoloration during heat are noteworthy properties, and because of the high equivalent weight of this new alcohol, the amount of acid required for esterification is low for a given weight of final ester. It is an extremely viscous sticky liquid, neutral, water-white, highly saturated, thermally and chemically stable with low volatility, lack of odor and taste, and solubility and compatibility characteristics which combine those of rosin and of a primary alcohol. Thus, as a plasticizer, resin modifier, tackifier, and adhesive modifier, the alcohol offers many possibilities.

SYNTHETIC PERFUMES

Recently George B. Bradshaw, of E. I. du Pont de Nemours & Co., Wilmington, Del., described some synthetic perfumes perfected by his company. He told, for example, of Astrotone synthetic musk, equivalent to the active ingredient derived from the Tibetan musk deer. This is produced from fatty oils derived from plants or animals. Other musk-like odors come from coal tar.

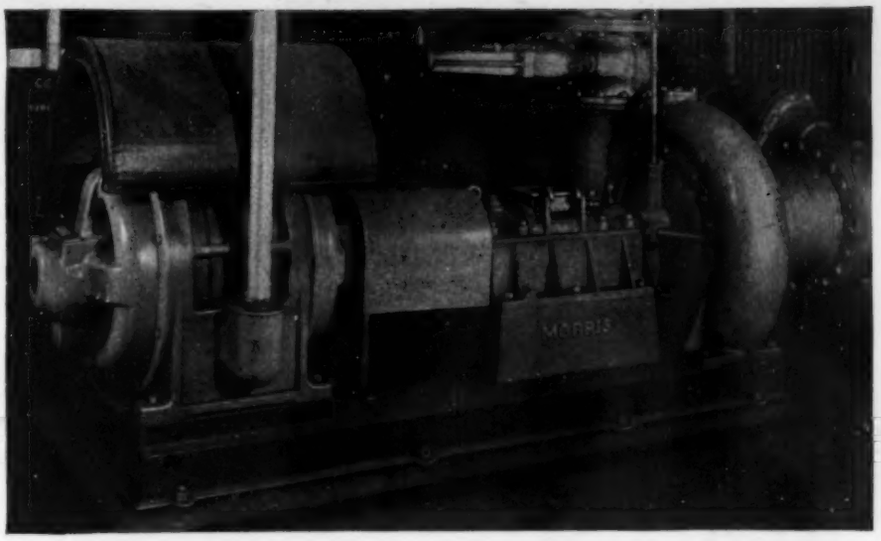
Skatole is a fine chemical duplication of civet, another classical perfume base, while Indole matches jasmine and is regarded as the *sine qua non* of exceptional perfumes. As attractive in every way as their natural counterparts, except in name, are isobornyl acetate and terpinyl propionate. They practically replace pine needle and rosemary oils and are often used instead of lavender. This pair is made from turpentine.

SYNTHETIC RUBBER REODORANTS

Odors which arise from some of the synthetic rubbers during processing and curing may be controlled by a series of products formulated by Givaudan-Delawanna, New York, N. Y. They work by masking the malodor. Thiodor No. 1 is the name of the deodorizing odor for Thiokol-N. Parador A, B, C, and D are designations for reodorants developed for Buna-N, Buna-S, butyl, Hycar, and neoprene, though not necessarily in that order. The Paradors have been found effective in concentrations as low as 0.1 percent of the synthetic rubber mix.

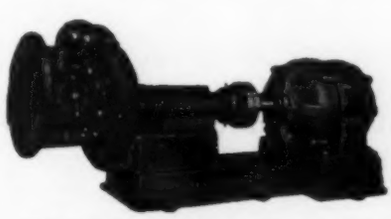
SURFACE-ACTIVE AGENTS

Two surface-active agents have been paced in production by Commercial Solvents Corp., Terre Haute, Ind. Known as Aciterage-OL and Alkaterge-O, these substances are unique in that they are stable in moderately acid solutions. Aciterage-OL is designed to function as a penetrating, emulsifying, wetting and foaming agent and appears to be of particular value in the textile and leather industries. Alkaterage-O is an oil-soluble material which is an effective emulsifying agent either as such or in the form of its fatty acid soaps. It is an oil-soluble dispersing and spreading agent and has found uses as a penetrating assistant for lubricants and oils.

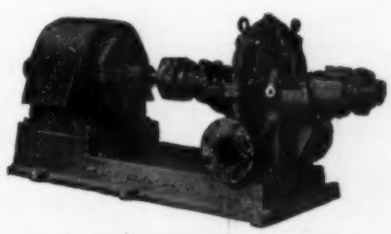


"It may be of interest to you..."

So wrote *an old-time customer when telling us that his 40-year old Morris Centrifugal Pump is still in daily service and too good to be replaced. It may interest YOU to know this too, for it indicates the stamina that has always been built into every Morris Pump. Whatever may be your pumping requirements, be sure to investigate Morris Pumps—they will give you high efficiencies and long troublefree service. Bulletins on request.*



ST-P Non-clogging Pump — Guaranteed Non-binding for Pulpy Mixtures



Double Suction Horizontally Split Pump for Clear Liquids

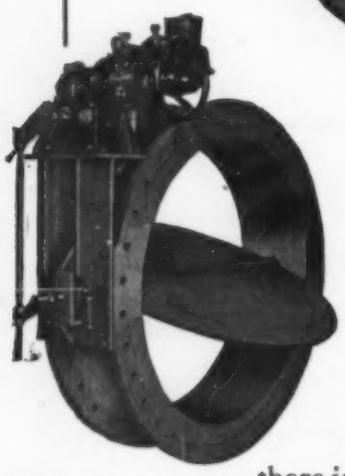
MORRIS MACHINE WORKS — MORRIS — ESTABLISHED 1864 — BALDWINSVILLE NEW YORK

CENTRIFUGAL PUMPS

Easy to Operate...

Streamlined for Self-Cleaning

16-inch cast iron chain wheel operated valve for pressures up to 15 pounds. Complete range of sizes from 2-inches to 84-inches.



Automatic electric-motor operated American Standard Valve with hand wheel for manual operation in case of current failure. Available in 125 lb iron, 150 to 900 lb steel.

The action of an R-S Butterfly Valve is rapid and smooth. Four to six revolutions of the hand wheel or chain wheel fully open or close the valve vane. The compact, inherently narrow face-to-face dimensions, and the fact that there is no long stem or gate well, reduce clearance requirements to the minimum.

There is free passage for direct flow with no restrictions other than the streamlined vane. Sediment cannot collect since there are no right angle bends or reverse turns. Hence, the R-S Valve is ideal for the control and shut-off of dirty gas, dirty water, pulverized fuel or similar flowing solids.

The beveled vane wedges tight against the valve body for shut-off duty.

Write for catalog and detailed information about the use of R-S metals for resistance against heat, abrasion and corrosion.

15 to 900 psi

VALVE DIVISION

R-S PRODUCTS CORPORATION

4523 Germantown Avenue Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

CAMOUFLAGE PAINT

A camouflage in the form of a dark green paint that foils camera detection has been developed by E. I. du Pont de Nemours and Co., Wilmington, Del. This dark green paint shows up light in aerial infra-red photographs, whereas ordinary green paint shows up dark, revealing details to the enemy. It acts as a camouflage since the military value of infra-red photography lies in the different way in which common objects reflect visible light and infra-red rays. Most green vegetation reflects infra-red light. If a military target were blended into the landscape by the artfulness of orthodox green paint, the painted surfaces would stick out like a sore thumb since they would be black and the foliage white. The camoufleur can use green paints now that not only visibly match surrounding natural greens, but also equal their infra-red reflectance powers and accordingly match in the infra-red photograph as well. Olive and field drab, loam black, earth red, brown and yellow are also obtainable for similar use.

PAINT-LIKE PLASTIC

For protection against corrosion and fungous growths of boiler drums, metal, wood or concrete storage tanks and water-submerged surfaces, the Saverite Engineering Co., Hoboken, N. J., has evolved a permanently plastic material which is applied like paint. It stretches and contracts with temperature changes because it never dries hard, thus eliminating the danger of hairline cracks in the coating which would permit undetected corrosion under the protective surface. When applied to already pitted surfaces, this plastic coating stops further pitting. It will not melt, freeze, crack or peel at temperatures from below freezing to 500–550 deg. F.

Serviron is widely used wherever clean, rust-free water is required. It also withstands certain acids, brines and caustics, and may be used to coat valves, ammonia lines and underground pipes and tanks. Serviron is odorless and tasteless, and is safe to apply in enclosed spaces, for it does not give off any obnoxious or dangerous gases. Since best results are obtained when it is applied directly to the surface in one coat, there is no need for a primer coat. Its pore-penetrating action forms a waterproof bond which cannot be jarred loose.

YELLOW FLUORESCENT

Instead of the glaring white or bluish-white color characteristic of present-day fluorescent lighting, Dr. W. A. Weyl of the American Optical Co. in Southbridge, Mass., has discovered a fluorescent material which produces a warm yellow color when exposed to ultraviolet rays. This fluorescent possesses the power to absorb invisible ultraviolet rays and transform them into visible light. Not only does this material produce a radically new color, but also it retains, unlike previous fluorescents,

the power to emit light even if the material contains impurities in the form of iron or nickel. It also glows without the addition to its composition of an activating agent like manganese, a necessary element in present fluorescents. These new properties simplify and make more economical the manufacture of the new fluorescent in comparison with those previously discovered. It is not yet available to the public.

FATTY ACIDS FROM ANIMAL FATS

Solid fatty acids, produced wholly from animal fats, possessing entirely different chemical and physical characteristics than the ordinary commercial grades of stearic acid sold heretofore, have been announced by the Emery Industries, Inc., Cincinnati. These new solid fatty acids range from high percentages of palmitic acid to high percentages of stearic acid.

The new fatty acids show not only differences in physical characteristics such as hardness, shrinkage and crystal structure, but also, when reacted chemically, produce finished materials having properties such as solubility, gelling of soap produced and other features different from those obtained with the usual grades of stearic acid. This is the first time, according to the manufacturer, that fatty acids of this type have ever been produced from fats of animal origin.

WATERPROOF SEALING TAPE

A waterproof, pressure-sensitive cloth tape, made by My Stick Tape Div. of Chicago Show Printing Co., without use of rubber, is said to be finding a wide variety of uses in war production. Since it is non-toxic, it can be used for sealing packages of medicine, blood plasma, foods of all sorts, surgical dressing and similar products. Because of its proven ability to withstand salt spray, dust and gas contamination, it can be used for sealing overseas shipments of ordnance equipment such as guns, tanks and aircraft. This tape is easily handled and applied. It can be stripped off and relocated despite the fact that its adhesive power is far greater than that of ordinary sealing tapes.

Its tensile strength is said to be very high. The cloth stock is so woven that it tears evenly at right angles to either edge. It is packed in rolls of any width up to 36 in.

BASE FOR LIQUID SOAP

Firms who prefer to prepare their own liquid soap products can use a new highly concentrated bland soap base containing 58 to 60 percent solids. This preparation, Kokobace, developed by National Oil Products Co., Harrison, N. J., requires only a tight barrel, drum or small mixing tank and a suitable means of filtering, in order to make it. The liquid soap is made by pouring hot water into the container and then adding the preparation. There

Tiering cartons on pallets three high with Baker Fork Truck to conserve storage space.

Tiering on racks allows access to underneath pallet load with Baker Fork Truck.

BAKER TRUCKS selected by Sherwin-Williams for model Chicago Warehouse

Horizontal storage on racks allows removal of single drums without disturbing drums above.

Box car or truck loading is speeded by handling pallet loads with fork truck.

When Albert Kahn designed the huge new Chicago warehouse for the world's largest paint manufacturer, no effort was spared to made it the last word in practical efficiency.

Since all of the operations in a warehouse involve material handling, it is highly significant that Baker Trucks and Tractors were specified to play the major role. Drag chain conveyors supplement the trucks to provide one of the most flexible mechanical handling systems of its kind yet developed.

BAKER INDUSTRIAL TRUCK DIVISION
of the Baker-Raulang Company
2146 West 25th Street, Cleveland, Ohio

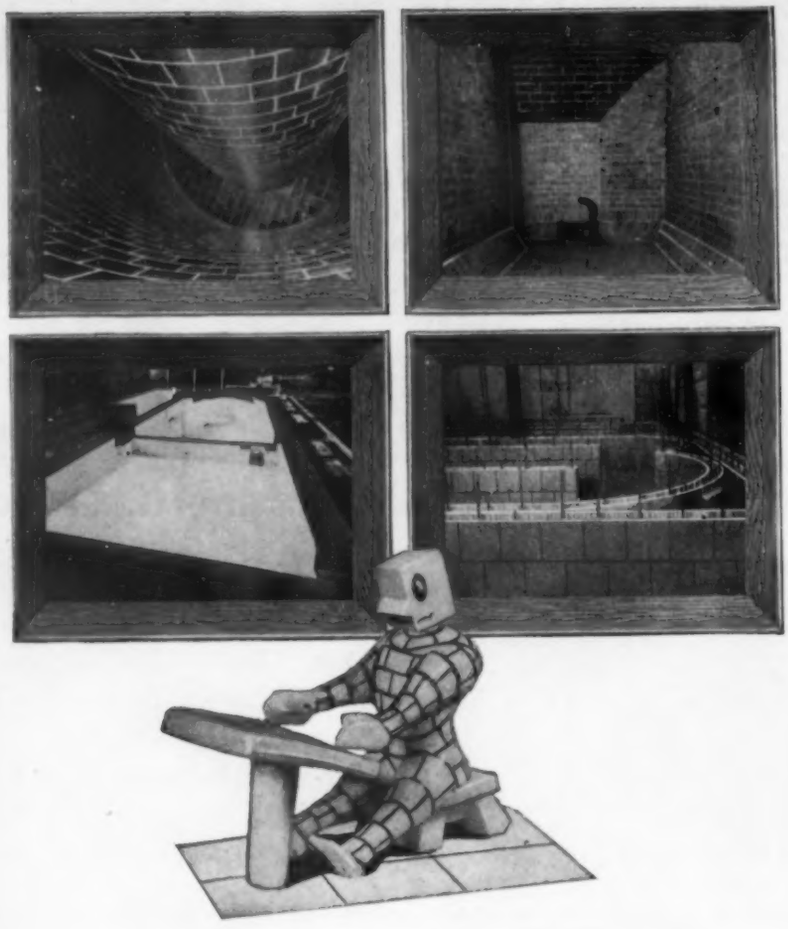
In Canada: Railway and Power Engineering Corporation, Ltd.

FACTS AND FIGURES

- Warehouse occupies space 288 x 624 ft.
- Has accommodations for 8 railroad cars and 20 highway trucks within building.
- Handling equipment includes fork truck and pallets, tractor and trailers, and conveyors.
- Packages comprise 50 and 30 gal. drums, 5 gal. pails and a wide variety of smaller units in cartons.
- Smaller items alone arrive from production at rates up to 60 per minute.
- More than 10,000 different items are received, sorted, stored, and shipped.

3061-1A-43

Baker INDUSTRIAL TRUCKS



Scope of **STEBBINS LINING AND TILE TANK SERVICE**

Stebbins offers a complete service on design, installation, maintenance and repair of corrosion resistant linings, both for acid and alkali conditions, backed by 59 years of experience in the lining and tile tank field.

We specialize in the heavier types of linings, which are built of brick, tile, porcelain and carbon materials. We also offer synthetic resin membranes, resistant coatings and rubber films where required in combination with brickwork to take care of specific conditions.

Our business is exclusively devoted to linings and tile tanks.

Call in Stebbins on your next lining or tile tank job

SEMCO

Stebbins Engineering and Manufacturing Company

367 EASTERN BLVD. WATERTOWN, N. Y.

are various formulas for making it of the desired anhydrous soap content and it can also be scented, colored, and given a bright appearance. Kokobace is made from vegetable oils especially processed to insure suds equal or superior to cocoanut oils without the drying effect on the skin, usually found in potassium cocoanut oil soaps.

ERADICATOR FOR POISONOUS WEEDS

Poison ivy, poison oak, chokecherry, wild black berries, and Russian, Canada and sow thistles, can easily be killed with a spray solution of a chemical known as ammonium sulphamate. The herbicide is non-poisonous, free from fire hazard and sterilizes the soil for a brief period only, while the weeds are eradicated permanently if properly sprayed. Weed destruction is achieved by absorption of the chemical into the foliage and thence down to the roots. Field experiments demonstrate that ammonium sulphamate spray causes no damage if it falls on tree trunks, although it should be kept from fruit tree leaves.

The base of the chemical is sulphamic acid, introduced by the Grasselli Chemicals Department of E. I. du Pont de Nemours and Co., Wilmington, Del., as a new industrial chemical 18 months ago. Since then the acid and its salts have been devoted wholly to war uses, but improved manufacturing now permits release of substantial quantities for herbicidal purposes.

SYNTHETIC BIOTIN

The synthesis of biotin, a powerful vitamin and one of the rarest and costliest substances known, has been announced by the American Association for the Advancement of Science in its publication *Science*. The synthesis was accomplished at the research laboratories of Merck & Co., Rahway, N. J., by Dr. S. A. Harris, Dr. D. E. Wolf, Dr. R. Mozingo and Dr. Karl Folkers. The world's entire supply of this supervitamin, a member of the family of B vitamins, so far extracted largely from liver, amounts to about one-tenth of an ounce.

HEAT INSULATION

Heavy-duty, high temperature pipe coverings and block insulation under the name Mascolite are now being made by Munn and Steele, Inc., Newark, N. J. Mascolite is basic-bonded, vermiculite body for service at temperatures below 2,000 deg. F. It is an extrusion product, cured and processed at high speed, in extremely short cycles. Among the advantages claimed for the material are high insulating efficiency, freedom from shrinkage in service, adequate strength, unharmed by water, accurate measurements and a unique corrugated inner wall surface which provides an air film between hot pipe and the body of its covering. Pipe covering in the entire range of sizes and thicknesses, as well as insulating slabs, back-up blocks, special shapes and plastic cement is now in full production.

I've Ever Seen"...

. . . "AND WE WILL CONTINUE TO MAKE CARBOY STOPPERS WORTHY OF THIS COMMENT." Says-

"Universal American"

"UNIVERSAL AMERICAN" . . . Rigorously tests its raw materials, carefully guards each production step, closely grades and measures its finished product, and thereby insures full specification compliance and uniform porosity.

"UNIVERSAL AMERICAN" . . . Has taken the guess out of carboy stopper production and with expert knowledge plus "Precision" machinery has accomplished that which older methods and machines never could accomplish.

"UNIVERSAL AMERICAN" . . . Will appreciate the opportunity of presenting "Proof" on your next carboy stopper inquiry and order.

Corporation

1500 UNION COMMERCE BLDG., CLEVELAND 14, OHIO

FROM THE LOG OF EXPERIENCE

THE PLANT ENGINEER'S LOG is customarily a formidable schedule of statistics, performing a service analogous to that of a dictionary. It is like a watch whose message is taken in at a glance and then straightway forgotten. It makes a record of the behavior of the machinery but omits the greater variety of behavior of the men who run the machinery. On the other hand, there is enough drama in the facts to make their record interesting as well as informative if they are attractively presented by words and pictures. Cast iron is a plastic thing in the hands of the engineer, but God made the "polander" and the job is complete. The performance of the machinery has to take his limitations into account as his idiosyncracies cannot readily be revised.

THE CLARITY AND USEFULNESS of the log increase with the time and effort applied by the engineer in writing it, and it will receive attention proportionately. The more thinking done by the consignor, the less will be demanded of the consignee. It is desirable to keep the "Old Man" informed about the engineering department's activities and plans, but if a subject cannot be covered in a page, he will probably lay it aside for "some other time." Studied brevity somehow improves perspicuity. The Boss is a grown-up man of nimble wit. He is distracted by a surplus of monosyllabic verbiage. His time is in great demand. Moreover, he is also human and likes to be informed about "his boys".

ALL OF THE PERSONAL EPISODES are part and parcel of the job and are therefore included in the log. The Old Man reads every word of it. Sometimes a study of a proposed installation appears, complete with a drawing (one drawing equals one thousand words!), costs and expected profit. Suddenly the telephone rings and the Old Man wants to know how soon we can start the job! And he himself cannot escape the record whenever he becomes implicated in some unusual episode. At least future generations of plant engineers can learn of the qualities of Boss "W.H." (W. H. Hoodless) who reported to Shackamaxon Ave. in 1913.

PHYSICALLY, THE LOG is made up of 8½x11-in. sheets of the highest quality of Crane's bond paper. It is thin and tough and makes clear blueprints. The type used is the small size pica and the spacing is 1½ times "single" which is not too crowded for comfortable reading nor too wide to waste space. For every page the Old Man reads, he gets a page and a half without knowing it. "I.P." loose-leaf covers are used, the same size as is supplied to every office in the plant where reports are made

Dan Gutleben, Engineer

and interchanged, and no other size is used except the 3¼ in. by 6¾ in. memo. books that slip into the foreman's hip pocket. The camera with F-4.5 lens, 130 mm., and Compur shutter uses 3¼ in. by 4¼ in. film packs. It serves effectively for mechanical, biographical and historical records and, by its demand on "spare" time it avoids ennui.

AN IMPORTANT FUNCTION of a log is the recording of failures of judgment. Many problems do not submit to arithmetical analysis and in such cases experience must be extrapolated. If the subsequent performance does not follow the graph, the loss is credited to education. There will be no excuse for a repetition as the new facts and the pitfalls will be of record. By special request copies of the log were once delivered to an accountant to satisfy his desire to keep abreast of the activities of the engineering department. He thought he might improve his service if he could anticipate the trends. Some time later a memorandum was received from the superintendent's office pointing out that the accounting department had discovered some costly errors in the engineering department's work. The accountant whose daily life is saturated with figures, cannot comprehend a mentality under which an error is exposed in a permanent record. Error does not rhyme with profit! So long as rubber and erasing shields hold out, his work will be free of errors. Furthermore he insists on accuracy equivalent to a physicist's. He carries out the cost of a thousand pounds of steam to the sixth decimal place.

SANDY, FLASHLIGHT between his teeth, shimmys up a column to get some dimensions needed for the construction of a new sugar bin. When he reaches the top, the flashlight slips and causes his upper "store" teeth to splash upon the floor. The company's flashlight hasn't been damaged much, but the top of the dome that holds his teeth in place is cracked off and so Scotsman Sandy substitutes the adhesion of a wad of chewing gum for the vacuum that has been lost. Meanwhile the log describes the bin as to its design, construction, cost and profitableness—it was in fact a creditable job. The next time the Old Man accosts Sandy, he will bum him for a stick of gum and Sandy will know that his efforts are appreciated.

THE BUSINESS COLLEGE professor of 1899 (as recalled by Herman Miller) propounded a parable to impress the importance of infallibility. An auditor in his interviews of applicants for a bookkeeping job asked each how he would correct an error. One had a special quality of rubber that could remove the last trace of error. Another claimed superior skill with the penknife. Others had various techniques that could obliterate any slip of the pen. The last one declared that he would make no mistakes. This one got the job!

WHEN HERMAN ARRIVED at the construction shanty in Croswell, Mich., he accepted an inheritance of a two cent shortage in his predecessor's accounts. Inasmuch as it was there and seemed harmless, he suffered it to remain and at the conclusion of the job deposited two cents in the bank, balanced his books and shipped them to headquarters in New York. However, the auditor did not approve of this procedure. Herman had to go over nearly a year of books and scrub and rewrite and expend $200 in payroll to eradicate the two cents.

THE INTRICACIES of accounting on another occasion are responsible for a service to the "cause" of sugar refining. Charlie Manning was laboring at the bottom of the ladder in a Bay City, Mich., sugar house about 1900. Progress was slow. He craved more abundance for his wife and baby, and accordingly took a day off from his labors and sought advice from a big raw-boned "professor" of the town business college. He explained that his financial circumstances made it imperative that he acquire the practical essentials for prompt conversion into ham and eggs. Speed was of the utmost importance. "How long would it take?" The professor knit his browns, studied Charlie intently for a long period, then enunciated "I can teach you all I know in one week, but I can't furnish you with brains." Charlie returned to his rung in the sugar house. This was a happy choice as it eventually led to the superintendency of the Pennsylvania refinery.

SUGAR CONTAMINATION IN FEED water has occasionally provided some of the baffling mysteries of plant operation. For a period of a month the boiler house was harassed by periodic contamination. Sugar converts to acid in the boiler, reduces the alkalinity and accordingly induces scale. During that troublesome month, the sugar leaks came and went "like a thief in the night". In the search for leaks some traces were found at various quarters and the respective surfaces repaired. Just when it was thought that the leaks had been found, *bang* another shot of sugar came down! Everybody theorized and searched. Superintendent Hank in desperation accused the boiler house gang of substituting an occasional bag of

Vitamin Extraction Plants

Designed by ACME..

The Vitamin Extraction Plant illustrated here, depicts another phase of the broad range and technical versatility of Acme engineering and manufacturing facilities.

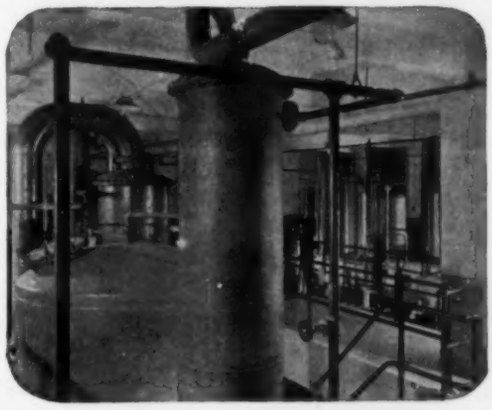
This installation, designed, engineered, and fabricated by Acme, operated by the Borden Vitamin Company in accord with their patented process, represents a marked advance in the rapidly expanding Vitamin program. Outstanding among the many features of this plant are ease and simplicity of operation, fineness of control, high quality of product, and low initial and operating costs. Because of the careful selection, recycling, and recovery of the solvent called for in this remarkable process, and the low temperatures maintained throughout the process, high efficiency of extraction resulted. Meriting attention in this accomplishment is the Acme system of film evaporation under high vacuum.

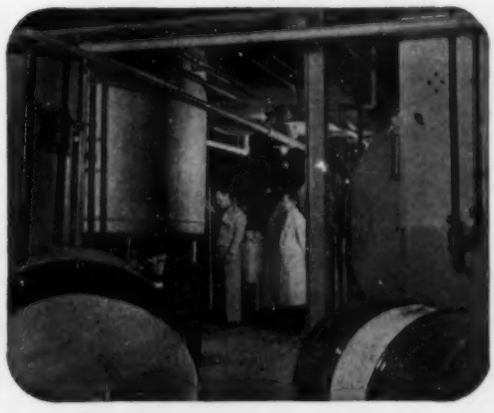
Thus in many cases, laboratory experimentation is converted into commercial operations by our designing engineers. Our equipment, adapted to processes conceived by the outstanding authorities in their respective fields, is today playing an important role in the Process Industries.

From planning to production, Acme engineers, designers, and craftsmen stand ready to assist in newly created problems—of war today—of peace tomorrow.

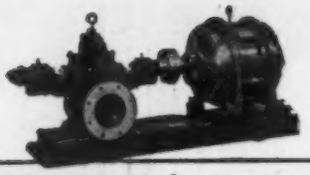
ACME
Processing Equipment

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA.

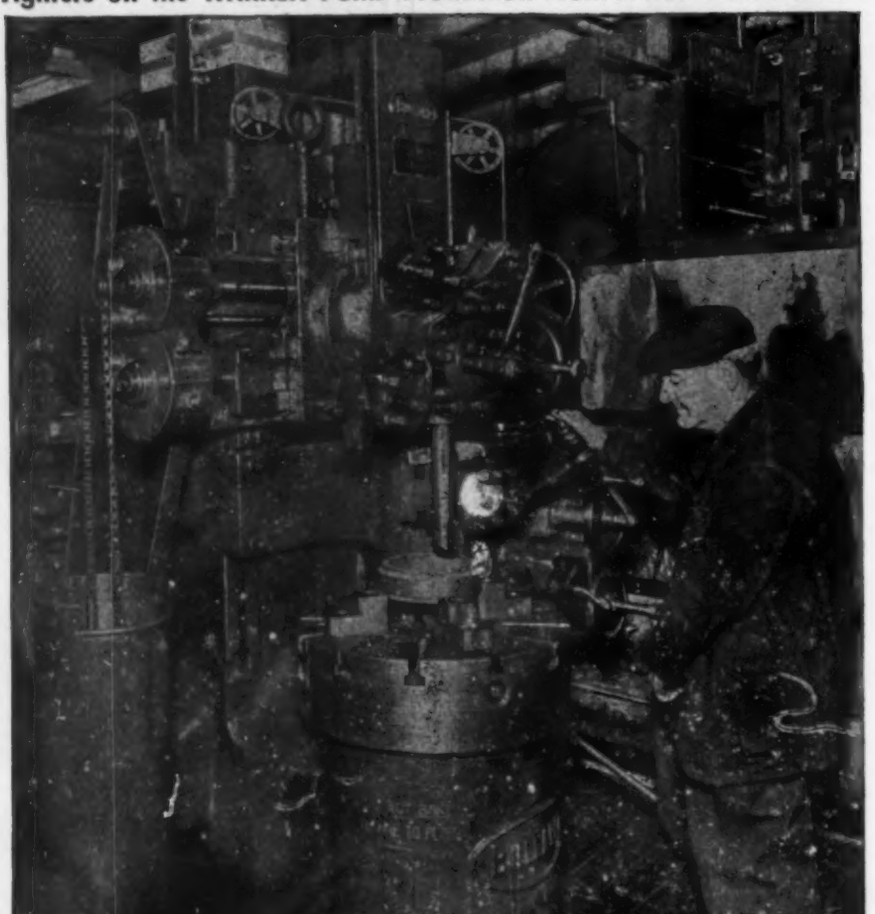




Heat Transfer • Evaporation • Drying • Distillation • Absorption • Extraction • Crystallization



Fighters on the WARREN PUMP Production Front.. No. 4 of a Series



"POP" BRINGS 30 YEARS OF SKILL TO EVERY JOB HE DOES

Chester B. Hathaway — ("Pop", to us) has had 30 years of service with Warren Steam Pump Company, Inc.

"Pop" is a vertical turret lathe operator of such skill that he can speed up with the very best of them . . . and is an artist at work which calls for close tolerances.

It is the experience, skill and conscientious effort of "Pop" and his fellow Warren employees that make it possible for Warren Pumps to be "built to fit the job," without any compromise in quality. And it is the pride that these skilled men take in Warren Pumps that enable Warren equipment to perform, so faithfully, their important job in helping to win the war.

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

sugar for a bag of caustic soda for water conditioning! Finally a snooper found the sniper. A faithful "polander" had installed a small pipe between the casing of a centrifugal pump and an exhaust steam line for the purpose of melting out a casual deposit of sugar crystals. This line branched out from the steam supply to the air heater of the sugar dryer and when the operator forgot to close the valve at the pump casing, the pump discharged sugar syrup into the air heaters, which sent their condensate into the boiler feed tank! Sometimes the operator remembered and for a period of time tranquillity returned. Nobody ever tested the condensate from the air heaters as there was no possibility of dry sugar getting into a radiator against an internal steam pressure!

JACK WINANS, expert boiler-maker, was sauntering down Chestnut St. when he passed the open door of an auctioneer. The activity of liquidating an old estate that had grown to moss had just reached the library. The bidding was apathetic, but Jack was interested. He had just made the final payment on his cottage in New Jersey and the auction presented an opportunity to pick up the means of erudition by the yard. He sensed a bargain and bought 60 yards of books at $1.60 per yard. Jack has experienced the feel of the chisel and hammer while lying on his back under the blistered belly of an old-fashioned fire-tube boiler. He has also to his credit a six year cruise with the greatest Navy in the world.

GOOD OLD WASYL (Mike) Fedecki differed from his compatriots in that he didn't shrug his shoulders and plead ignorance when he made a mistake. One Sunday afternoon at 2, Mike came running through the melter house breathless and seriously disturbed. He wanted the master mechanic right away. The chronicler learned from his gesticulations that the old flight coal conveyor had been wrecked. Mike confessed that he had nodded and, in a moment of obliviousness, the bunker at the far end blocked the conveyor and accomplished an unusually thorough job of demolition. The reception that his distressing report met, surprised Mike almost as much as the wreck itself. It was refreshing and time-saving to have the mystery cleared up with a frank confession, and so Mike was told to go back and clean up the mess and directly a crew of mechanics would be on the job to make the repairs.

AN EMPTY DRUM was standing innocently under the fermenters. Above, a welder was plying his specialty under dispensation from the superintendent of the alcohol plant. Suddenly there was a violent swoosh as from a cannon! A spark had found the 2 inch bung and the drum contained an explosive gas. The heads bulged out in the form of a hemisphere, hit a fire sprinkler in the ceiling and the welder was scared out of a year's growth, but otherwise the education of the welder was improved without cost.

LOW PRESSURE STEAM is economically obtained from a high pressure source by reducing through a power generator or an evaporator, but the lack of funds or other practical considerations may require the use of the simpler device of a steam reducing valve. Our old coil pans, discarded in '34, were designed for 80-lb. steam pressure which Supt. Hank Wilkins, in his eagerness for more speed, desired to increase. Boiler House Foreman Tom often found that the reducing valve as well as the safety valve on the 80-lb. line had been tampered with so as to raise the pan supply to 90 lb. This disturbed Tom as the frequently recurring practice of the sugar boiler in opening wide more than one pan steam-charging valve at a time, jolted the hourly flow by an instantaneous jump of 60,000 lb. for each pan, and (before the steam accumulator was installed) this sometimes cut his 150 lb. boiler pressure to 90 lb. and made the lights grow dim. Tom therefore locked the valve but relented when Hank expressed displeasure because of the implication! Nevertheless, the next day as Tom was making his rounds near the valve, Hank came whizzing by followed by an ear-splitting roar of safety valves which Hank thought was an explosion. Circumstantially it was clear that Hank had boosted the reducing valve, but had overlooked the safety valve. Thereafter, the adjustment was left to Tom.

A CARPENTER who had grown old and contented in the routine of maintenance work coveted some of the big money that dangles under the nose of the government subsidized jobs. On a Monday morning his wife reported him sick, and during his AWL he got a job in the pattern shop of a great shipyard in Camden. He was assigned to the task of cutting templates on a piece work basis in competition with a crew of young girls of agile wit and fingers. In a few days he called up our time office and reported that his indisposition would soon be overcome and he expected to be able to return to his job on Monday.

HANK WILKINS used to have a gang of janitors of Ethiopian hue. Their besetting sin was to extend the midday snooze till long after the whistle blew. After lunch they would enjoy a sun bath on the pan house roof and forget to wake up. One day Hank happened to be at a window in the char house tower overlooking the pan house, and observed his Ethiopians at peace with the world. Straightway he called up the time office and instructed, "Vile dey sleep dey git paid. Ven dey vake up dey git fired."

THE HIGHLY POLISHED stainless steel sheets that were available during the piping times of peace serve for many important purposes. We installed them years ago to serve as mirrors for deflecting light into refined sugar bins in order to remove the prejudice of having electric light bulbs within explosive distance of our highly esteemed product!

NEW REEVES *Reducer-Type* TRANSMISSION

Stepless Speed Adjustability and Reduction Without Use of Other Auxiliary Equipment.

COMBINES VARIABLE SPEED TRANSMISSION AND GEAR REDUCER IN SINGLE, COMPACT UNIT . . .

The REEVES Variable Speed Transmission—the process industry's widely accepted unit for providing accurate, infinite speed adjustability—is now available with built-in, helical-type speed reducer. With this new REEVES drive, the operator of any production machine has a wide range of low driving speeds instantly available in a single compact unit.

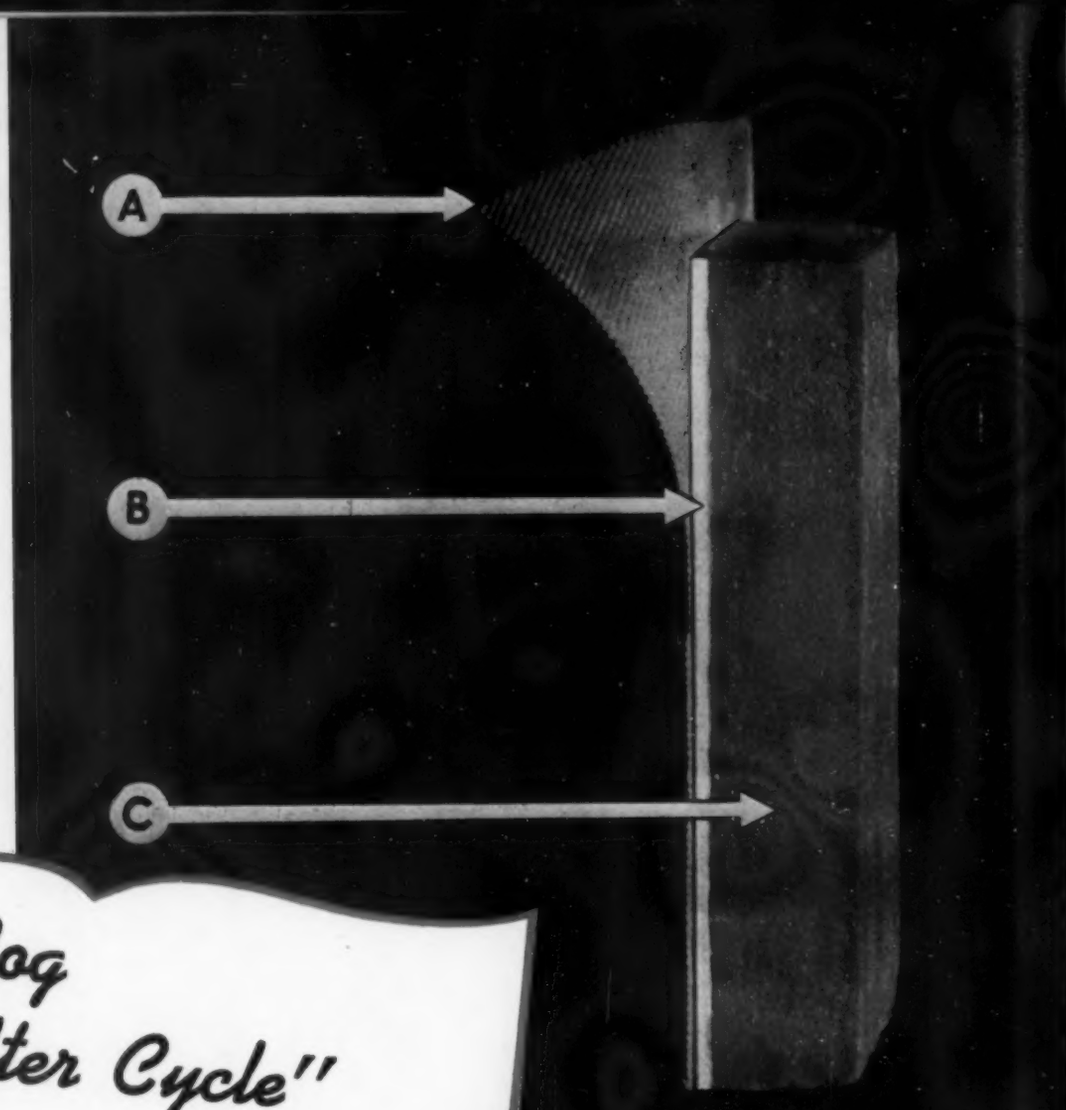
The entire range is covered without steps or jumps. Any required speed for best production under each changing condition is accurately obtained by turning a handwheel, without stopping driven machine or interrupting production. It's easy to equip this unit for individual motor drive by means of REEVES adjustable motor base, which accommodates any available motor. Send for 16-page catalog CM-432, giving complete engineering information.

Vertical design, especially adapted for incorporating into driven machine or for conditions where floor space is limited.

REEVES PULLEY COMPANY, COLUMBUS, INDIANA

Accurate Variable

REEVES SPEED CONTROL



"The Log of a Filter Cycle"

This photograph is a "certificate of efficiency" in filter operation—an example of effective use of filteraids for maximum output and economical production. It pictures a small section of an actual filter cake. The cloth (A) peels away cleanly, and will wash easily. Its full area has been open for flow of the liquor, because the meshes have been protected from clogging by a good precoat (B). This precoat —the thin white layer next to the cloth—is uniform, and its color points to application with clean liquor. The even color tone and uniform texture of the main cake (C) show that filteraid was added regularly throughout the cycle and that the record can be expected to show excellent clarity and flowrate. This cake filled its space in the press and maximum pressure was reached, signifying use of the correct grade and amount of filteraid. It is the "Log of a perfect filter cycle," but faulty operation would show up just as clearly. A very thin dark streak would mean a momentary sliming of the filtering surface, while a thick dark layer would usually end the cycle, both due to irregular filteraid addition. Precoat or main cake deposited unevenly—having considerable variation in thickness—would be evidence of dirty filter cloths, perhaps the result of a former poor precoat or none at all.

DICALITE
FILTERAIDS

Unique in diatomaceous structure, and processed to rigid technical specifications, Dicalite filteraids give most efficient and economical filtration of all types of liquors. Desired clarity at high flowrates increases production, reduces costs, and contributes toward improved quality of products. Twenty-four hour production of Dicalite filteraids in TWO plants insures ample supply and prompt shipments.

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FILTERAIDS • FILLERS • INSULATION • ABSORBENTS • ADMIXTURES

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JOBBERS AND OFFICES IN PRINCIPAL CITIES OF U.S.A. AND REPRESENTATIVES IN FOREIGN COUNTRIES

PERSONALITIES

Harvey Merker

Robert F. Ruthruff

✦HARVEY M. MERKER, superintendent of manufacturing, Parke, Davis & Co., Detroit, has had conferred upon him the honorary degree of doctor of science by Wayne University of Detroit. In 1940 the University of Michigan gave him the honorary degree of doctor of engineering.

✦M. BERNARD MORGAN, plant engineer at the American Viscose Corp., Meadville, Pa., plant, has been elevated to an administrative post in the engineering department of the company at its headquarters in Wilmington, Del. He will be succeeded by Mr. HUGH MILLER, who has served as assistant plant engineer since 1939. Mr. Hill will fill a position being created in the corporation's engineering department in which he will have administrative responsibilities in each of the seven Viscose plants.

✦A. J. V. UNDERWOOD, Joint Honorary Secretary of the Institution of Chemical Engineers, has returned to London after approximately a month in this country during which time he was inspecting American plants.

✦WILLLIAM P. WOODSIDE has resigned his post as vice-president in charge of research of Climax Molybdenum Co. After spending the past half century in the steel industry, he now intends to spend the major portion of his time on his farm in Oakland County, Mich. He is still retaining his interest in Park Chemical Co., of which he is chairman of the Board of Directors.

✦THOMAS E. FRENCH has been awarded the Lamme Medal given annually for outstanding achievement in engineering education by the Society for the Promotion of Engineering Education. Professor French is in the Department of Engineering Drawing of Ohio State University.

✦ROBERT F. RUTHRUFF has been appointed director of research for Sherwin-Williams Co., and its allied companies. Dr. Ruthruff, a graduate of the University of Michigan, is widely known for his experimental and research work on various oils, gases, resins and their byproducts. Prior to joining Sherwin-Williams in 1939, he was associated with E. I. du Pont de Nemours & Co., Standard Oil Co. of Indiana, and M. W. Kellogg Co.

✦BERNARD E. PROCTOR, professor of food technology at Massachusetts Institute of Technology, has been appointed director of subsistence research section, research and development branch, Military Planning Division, Office of the Quartermaster General. He will succeed Dr. FREDERICK C. BLANCK, who has resigned to return to his former post as chief research chemist of H. J. Heinz Co., Pittsburgh.

✦P. E. ROLLHAUS, superintendent Plant No. 2, Ugite Sales Corp., Philadelphia, has resigned to accept a position with Arthur D. Little, Inc., Cambridge, Mass.

✦JOSEPH A. BAKER has been elected vice-president and director of Baker Perkins, Inc. Mr. Baker lived in Saginaw, Mich., for a number of years before moving to Toronto in 1938. He is president of Canadian Baker Perkins, Ltd., and has charge of all Baker Perkins activities in Canada. He returned to Michigan June 1.

✦JAMES A. HARLEY has been elected director of Baker Perkins, Inc. He joined the organization in 1934 after graduating from the University of Toronto. After a year of practical work in the shop he spent two years in Europe working on various engineering problems. He returned to Michigan in 1937, joining the engineering staff of the chemical machinery department. During the past year he has been in charge of the war work sub-contract department.

✦HAROLD E. HALL has been elected president of Metals Disintegrating Co., Elizabeth, N. J. He has been general manager of the company for the past six years.

✦WARD V. EVANS, chairman of the department of chemistry at Northwestern University, Evanston, Ill., has been appointed by the Mayor of Chicago as chief gas officer of that city.

✦EDMOND DU PONT has been named vice-president in charge of plant operations for Wilmington Chemical Corp., New York, N. Y. Mr. du Pont, who will make his headquarters in Wilmington, Del., will direct all of the firm's manufacturing activities.

✦A. E. SHERNDAL, plant superintendent of the Winthrop Chemical Co., has been elected vice-president of the organization. Dr. Sherndal was awarded honorary degree of doctor of science recently by St. Lawrence University in recognition of his research work in the manufacture of a quinine substitute.

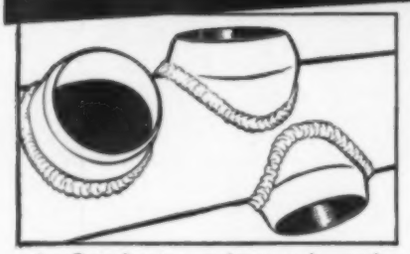
✦LOUIS H. BROWN, president of Johns-Manville Corp., had conferred upon him the honorary degree of LL.D. at Brown University's commencement exercises June 2.

✦WILLIAM P. DRAKE, recently appointed manager of sales of Pennsylvania Salt Mfg. Co., has been placed in charge of the company's sales of acid and alkali-resistant cement and chlorinated organic chemicals, in addition to his former duties as manager of Pennsalt Cleaner Division. Two chemical engineers, ALBERT H. CLEM and JOSEPH J. DUFFY, formerly in the Detroit and Rochester territories, respectively, were brought to Philadelphia to assist Mr. Drake in the Pennsalt Cleaner Division.

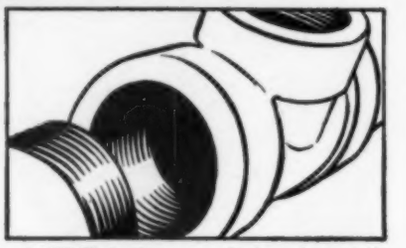
✦A. E. HIGGINS, vice-president and sales manager for the Pittsburgh Equitable Meter Co., Merco-Nordstrom Valve Co., Pittsburgh, Pa., was commissioned as Major in the U. S. Air Corps, May 8. He was called immediately for active service. A veteran of World War I, Major Higgins has held a Reserve Officer's Commission for many years.

✦H. H. MEYERS, who recently resigned as chief of the WPB nitrogen unit, after serving for 20 months, and who still serves as a consultant to the chemical division, has been elected a vice-president of Virginia-Carolina Chemical Corp., Richmond. Mr. Meyers has served

HOW W-T'S* SPEED UP PIPING INSTALLATIONS

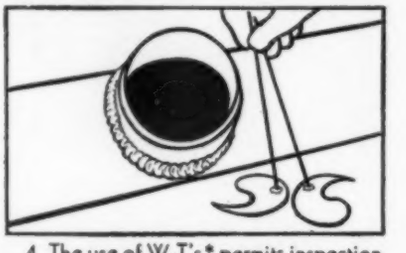


1. Branch pipe outlets can be made with W-T's* anywhere on the main pipe without the use of templets.

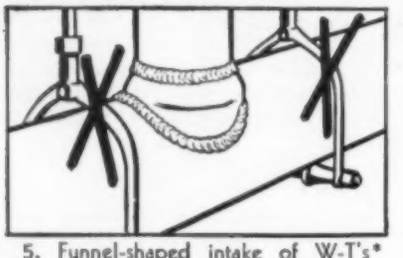


2. W-T's* eliminate all threading and fitting of main pipe in making branch pipe outlets.

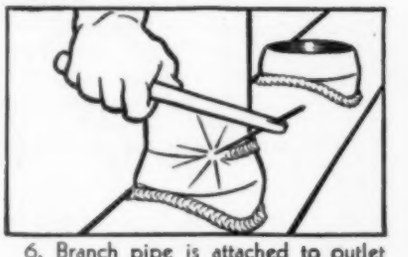
3. If outlet is 2" or smaller, hole is cut in the main pipe with drill or hole-saw before W-T's* are installed—on larger sizes, with torch after installation.



4. The use of W-T's* permits inspection of inside of joint, removal of scale and excess weld metal before branch is attached.



5. Funnel-shaped intake of W-T's* reduces vibrational stress at junction—eliminates need of extra braces and hangers.



6. Branch pipe is attached to outlet of fitting by welding—or, if outlet is threaded by screwing into outlet of fitting. W-T's* provide leakproof junction of full pipe strength.

W-T's* are suitable for all commonly used pressures and temperatures in every type of piping system. They can be installed before or after erection of the main line with ease and economy. Equally well adapted to pre-fabricated or "on-the-job" assemblies. Cost no more—in many cases less than ordinary fittings without their advantages. Stock fittings of drop forged steel, but to meet special conditions can be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Write for Bulletin WT-31 giving complete description of all advantages.

***WeldOlets-ThredOlets**

3 Types Meet Every Need

Beveled outlet of WELDOLETS permits branch pipe to be attached with plain butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet of fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All 3 types available for all standard pipe sizes up to 24".

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.

WELDOLETS•
TRADE MARKS REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

the corporation as manager of the purchasing department since 1936. Prior to that he was engaged for many years in research on fertilizer and heavy chemical problems, first with the American Smelting & Refining Co., later for a period of years he occupied the Armour Research Fellowship at Mellon Institute and then with Barrett Co.

✦ JOHN A. FAUST has joined the Bakelite Corp., Unit of Union Carbide & Carbon Corp. He will be on the staff of the Research and Development Laboratories in Bloomfield, N. J. Mr. Faust was graduated from the University of Michigan with a B. S. degree in chemistry in 1941. In the following year he received his M.S. degree in pharmaceutical chemistry from the same college.

✦ D. K. BALLMAN will head the service and development division for the Dow Chemical Co. This new division will be interested in the development of new chemical products for use now and after the war, and to extend the wartime usage of present products and facilities. His offices will be in Midland, Mich.

R. C. Osterstrom

✦ R. C. OSTERSTROM, who for the past 20 years has been connected with Pure Oil Co., resigned in May to accept the position of vice-president in charge of manufacturing for the Velsicol Corp., Chicago. In 1923 he joined the Pure Oil Co. as chief chemist, subsequently becoming executive assistant to the vice-president in charge of manufacturing. Recently Mr. Osterstrom was located in Toledo, Ohio, as manager of the company's refinery in that city.

✦ H. N. RILEY, in charge of research and quality control department of H. J. Heinz Co., Pittsburgh, has been elected vice-president of the company.

✦ FRED PRINCE has been appointed by Pennsylvania Salt Mfg. Co., Philadelphia, as manager of sales. For the past three years he has been manager of the company's laundry and dry cleaning division. He will be in charge of sales of hydrofluoric acid and anhydrous hydrogen fluoride, as well as several of the company's other chemical prod-

cts, and he will retain jurisdiction ver the laundry and dry cleaning divi- on. Assisting Mr. Prince will be HARLES M. FEHR, formerly chief chem- at the Easton plant.

HUGH M. HUFFMAN has been ap- inted to direct the operations of a w laboratory at the Bureau of Mines, troleum Experiment Station, in Bart- sville, Okla. Dr. Huffman was for- rly at California Institute of Tech- logy, Pasadena.

A. E. JURY, of the United States Rub- r Co., has been appointed associate nager of the Buna S Synthetic Rubber ant at Los Angeles Harbor. The plant as financed by the RFC and will be intly operated by the Goodyear Tire & ubber Co. and the United States Rubber o. through a newly formed corporation be known as the California Synthetic ubber Corp.

M. H. BAKER has been transferred om the Davison Chemical Corp. plant Curtis Bay to the headquarters in altimore where he will serve in the pacity of field service engineer.

PAUL W. COPENHAVER, formerly of troudsburg, Pa., is now a First Lieu- nant in the U. S. Army Engineers. e is serving with the Third Basic .O.T.R., Company G, Fort Belvoir, Va.

M. R. SCHMIDT, a member of Standard il Co. of Indiana for 26 years and as- stant general superintendent of the mpany's Whiting, Ind., refinery, has en promoted to general superintendent Whiting. Dr. Schmidt will succeed e late F. D. REXWINKLE.

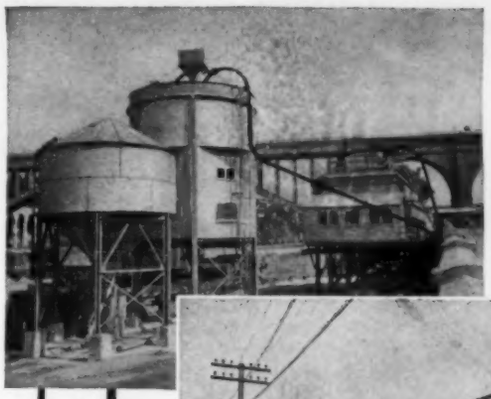
HERBERT M. KAUFMAN, formerly presi- nt of the Mutual Chemical Co. of merica, has been elected chairman of e board of directors. GEORGE A. BEN- GTON, formerly executive vice presi- nt, was elected president.

FRANK L. WRIGHT has been advanced the position of manager of research at orma-Hoffmann Bearings Corp. He as formerly chief metallurgist.

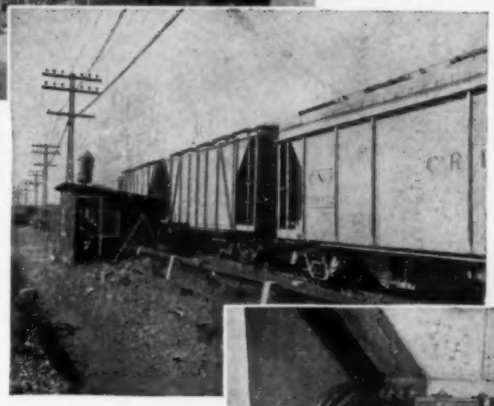
J. J. PYLE has been appointed chemist charge of the General Electric Co.'s lastics laboratories to succeed Dr. G. F. 'ALELIO who has resigned. Dr. Pyle rmerly was group leader in charge of search and chemical development of e company.

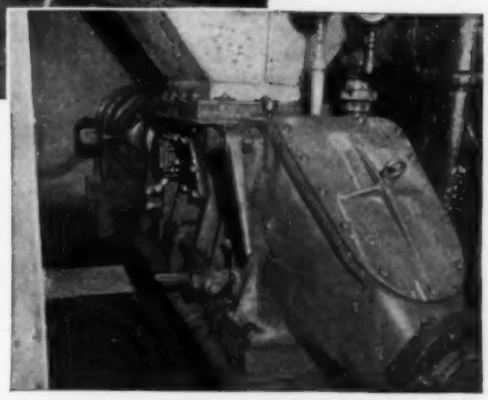
GEORGE M. MUSCHAMP and PAUL L. OLDSTROHM have been appointed vice residents of the Brown Instrument o. Mr. Muschamp will be in charge of gineering and Mr. Goldstrohm will be charge of production.

HARRY W. LUNDIN has become a mem- r of the staff of Monsanto Chemical o. as director of safety and plant pro- ction section of the department of in- strial relations. Mr. Lundin is a me- anical engineer and was formerly with e Liberty Mutual Insurance Co.



Conveying cement from hopper-bottom cars to ready-mix plant. Conveying distance 700 feet.





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SOME MATERIALS CONVEYED BY FULLER-KINYON SYSTEMS

- Arsenic dust
- Asphalt filler dust
- Bag fume
- Baroid
- Barytes
- Catalyst
- Cement (Portland)
- Cement raw materials
- Clays (dried)
- Colox
- Copper converter dust
- Dextrine
- Dolomite
- Fullers earth
- Gypsum (raw)
- Lime (quick)
- Magnesite
- Manganese Dioxide
- Ore (pulverized)
- Rock dust
- Siliceous Powder
- Starch (Pearl)
- Starch (Powdered)

Handle your dry pulverized materials safely through pipe lines . . . up-hill, down-hill, horizontally or vertically, overhead or underground . . . anywhere a pipe line can be run. Clean, explosion proof conveying; no danger of silicosis.

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MEETINGS AND CONVENTIONS

JUNIOR CHEMICAL ENGINEERS OF NEW YORK ELECT NEW OFFICERS

NEW OFFICERS elected by the Junior Chemical Engineers of New York at the last meeting of this organization were as follows: president, Lt. Raymond P. Devoluy, U. S. Navy Materials Lab., Brooklyn, N. Y.; vice-president, Edward T. Maples, M. W. Kellogg Co., New York; sec.-treasurer, Andrew E. Chute, Foster-Wheeler Co., New York; asst. sec.-treas., Frank Melaccio, Fratelli Branca & Co., New York.

Discussed at the last meeting by S. D. Kirkpatrick, editor of *Chem. & Met.* and Stephen L. Tyler, executive secretary of the American Institute of Chemical Engineers, were the subjects of chemical manpower in the war effort and the Kilgore Bill and its implications. All discussions were informal, being led by questions from the floor.

A.S.T.M. DUDLEY MEDAL AWARDED TO WALTER BONSACK

FOR HIS extensive technical paper published in August 1942, Walter Bonsack, chief metallurgist and director of research laboratories, the National Smelting Co., Cleveland, Ohio, was awarded the 1943 Dudley Medal of the American Society for Testing Materials at its meeting on June 30. This award commemorates the name of the society's first president and is made in recognition of technical papers of outstanding merit.

The paper, entitled "Discussion of the Effect of Minor Alloying Elements on Aluminum Casting Alloys," gave critical discussion of the role which various elements play in different types of casting alloys. Mr. Bonsack concluded that of the minor alloying elements which affect mechanical properties of the alloys studied, the only element which requires rigid control is magnesium. In practically all alloys, 0.10 percent magnesium is the maximum which can be tolerated without causing loss in ductility.

AMERICAN SOCIETY OF TESTING MATERIALS ELECTS NEW OFFICERS

NOMINATIONS for officers of the American Society for Testing Materials for 1943-1944 have been announced. Official notice of election was given at the tenth session on Wednesday evening, June 30, of the A.S.T.M. annual meeting in Pittsburgh, Pa.

Nominated officers were as follows: president, Dean Harvey, materials engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; vice-president, J. R. Townsend, materials standards engineer, Bell Telephone Laboratories, Inc., New York, N. Y. Members of the executive committee nominated were as follows: T. A. Boyd, Fuel Department, Research Laboratories Division, General Motors Corp., Detroit, Mich.; W. H. Finkeldey, Singmaster and Breyer, New York, N. Y.; E. W. McMullen, director of research, The Eagle-Picher Lead Co., Joplin, Mo.; E. O. Rhodes, technical director, Koppers Co., Tire and Chemical Division, Koppers Bldg., Pittsburgh, Pa.; F. G. Tatnell, manager Testing Equipment Dept., Baldwin-Southwark Div., The Baldwin Locomotive Works, Philadelphia, Pa.

AMERICAN CHEMICAL SOCIETY PLANS MEETING IN PITTSBURGH

THE CENTRAL theme of the 106th meeting of the American Chemical Society in Pittsburgh, Pa., will be "Catalysis of War Chemistry." The meeting will be held September 6-10.

"Manpower," called the most serious problem confronting the chemical industry, will be the subject of a three-day symposium at which industrial leaders will discuss measures to overcome shortages of trained scientific workers essential to the war effort. W. L. Elder of the War Production Board will preside at this symposium.

Food needs of the United States, civilian and military, and of the United Nations, will be explored in symposia dealing with recent advances in the chemistry of dairy products, vitamins, proteins, and boron in agriculture.

Other symposia will be devoted to antisyphilitic agents, industrial hygiene, research tools of the colloid chemist, research management in small laboratories, unit processes, paints, plastics, reactions of solids, molecular addition compounds, and library technique.

Francis C. Frary, director of research of the Aluminum Company of America, has been appointed honorary chairman of the convention. Prof. J. C. Warner, department of chemistry, Carnegie Institute of Technology, is general chairman. William P. Yant, director of development and research, Mine Safety Appliances Co., is general vice-chairman.

F. J. Curtis, Monsanto Chemical Co., will be chairman of the symposium on research management of small laboratories under the auspices of the division of industrial and engineering chemistry. Technological developments in industry will be traced in a unit process symposium at which Prof. R. Norris Shreve, of Purdue University, will preside.

Divisional meetings will begin on Monday, September 6, and conclude on Friday. Sessions are scheduled by the Society's Council and Board of Directors, of which Thomas Midgley, Jr., vice-president of Ethyl Corp., is chairman. A public meeting at which general addresses will be delivered has been arranged for Wednesday. Headquarters of the convention will be at Hotel William Penn, where registration of delegates will begin Sunday afternoon, September 5.

JOINT FUELS CONFERENCE TO BE HELD IN OCTOBER

ANNOUNCEMENT has been made of a Joint Fuels Conference of the American Institute of Mining Engineers and American Society of Mechanical Engineers, to be held at the William Penn Hotel, Pittsburgh, Pa., on Thursday and Friday, October 28 and 29.

A general committee established by representatives of the two associations consists of T. E. Purcell, chairman, H. F. Hebley, L. E. F. Wahrenburg, A. W. Thorsen, T. J. Barry, and H. P. Greenwald. The group has already appointed several subcommittees headed by the following chairmen: T. J. Barry, arrangements; Martin A. Mayers, program and papers; M. R. McConnell, inspection trips; J. T. Ryan, Jr., publicity; G. A. Shoemaker, hotel and registration.

PURCHASING AGENTS ASSOCIATION OF NEW YORK ELECTS NEW OFFICERS

NORMAN O. AEBY, purchasing agent of the Johns-Manville Corp., New York, was elected president of the Purchasing Agents Association of New York at the annual meeting held June 15.

Other officers elected were: vice-president, Millard W. Merrill, United States Metals Refining Co.; vice-president, David M. Meeker, Celanese Corporation

CALENDAR

SEPT. 6-10	American Chemical Society, 106th Meeting, Hotel William Penn, Pittsburgh, Pa.
SEPT. 21-24	Technical Association of the Pulp & Paper Industry, Wartime Service Conference, Palmer House, Chicago, Ill.
OCT. 13-16	The Electrochemical Society, Hotel Pennsylvania, New York, N. Y.
NOV. 14-16	American Institute of Chemical Engineers, 36th annual meeting, Pittsburgh, Pa.
DEC. 6-11	Nineteenth Exposition of Chemical Industries, Madison Square Garden, New York, N. Y.

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THE ONLY WRENCH WITH ALL THESE FEATURES . .

- Each head fits two different sizes of nuts
- Positive, instantly reversible ratchet action
- Can be used over long studs
- Does not chew nuts
- Operates in narrow spaces
- Tightens nuts quicker
- Cannot slip off nuts

Three sizes of handles . . . each handle takes five different heads . . . each head fits two different size nuts. Write for circular and prices. Carried by leading mill supply houses.

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of America; treasurer, E. B. Fielis.

New members of the board include James H. Ewing, Calco Chemical Division, American Cyanamid Co.; Harold G. Butterfield, National Union Radio Corp.; James L. Crosbie, Dexter Folder Co.; George F. Plate, Equitable Office Building Corp.

T.A.P.P.I. TO HOLD CONFERENCE IN CHICAGO

THE NEXT meeting of the Technical Association of the Pulp and Paper Industry, the Wartime Service Conference, will be held in the Palmer House, Chicago, Ill., September 21-24, 1943, it has just been announced. Prospective attendance has been estimated at about one thousand persons interested in the pulp and paper industry.

EDGAR MARBURG LECTURE BY MARKWARDT

ONE OF the country's leading authorities on timber, L. J. Markwardt, chief, Division of Timber Mechanics, U. S. Forest Products Laboratory, Madison, Wis., presented the Eighteenth Edgar Marburg Lecture on "Wood as an Engineering Material" at the 1943 annual meeting of the American Society for Testing Materials in Pittsburgh, June 28-July 2. Mr. Markwardt dealt primarily with war uses of wood, covering significant research accomplishments both with respect to the utilization of material in its natural form and in modified form through the use of glues, synthetic resin, etc. He covered advancements in seasoning technique, various adhesives, and plywood.

SELECTIONS FROM CONVENTION PAPERS

BUTADIENE BY THE GLYCOL PROCESS

THREE routes have been proposed for synthetic rubber production from grain: (1) through butyl alcohol; (2) through ethyl alcohol; (3) through 2,3-butylene glycol.

Efforts of Joseph E. Seagram & Sons, Inc., have been concentrated on the glycol process because a careful comparison of the three processes has revealed that one bushel of corn (61 percent starch, wet basis and 12 percent moisture) will yield butadiene as follows:

(1) 2.09 lb. by the butyl alcohol process;

(2) 5.80 lb. by the ethyl alcohol process; and

(3) 7.50-8 lb. by the butylene glycol process.

Assuming that the 8.0 lb. yield by the butylene glycol process is 100 percent efficient, then the ethyl alcohol process is 73 percent and the butyl alcohol process 26 percent as efficient.

Furthermore, the purity of the butadiene produced is scaled in about the same order. This glycol process is the only process, grain or petroleum, that will deliver 98.5 percent pure crude butadiene from the converter.

The power of this process to survive after the war is increased by the fact that butylene glycol, produced from farm crops, will be a new chemical with potentially many uses.

Our research on this process has involved a study of three phases: (1) fermentation; (2) recovery and (3) conversion to butadiene. This work is coordinated with that conducted by the scientists at the Northern Regional Research Laboratory of the United States Department of Agriculture, Peoria, Ill.

In fermentation the culture employed is *Aerobacter aerogenes*. This organism does not ferment starch. Since malt conversion is unsatisfactory because it is not sterilized at conversion temperature, the grain must be hydrolyzed by acid. The conditions and processes for continuous acid hydrolysis have been developed, making it possible to convert 95-100 percent of the starch into sugar. From an aerated mash to which urea and calcium carbonate were added, we have produced 13.0-15.0 lb. of glycol per bushel of corn. Further research may well raise this figure to 16.0 or even more.

Considerable work has been accomplished with the butanol solvent extraction of glycol from the mash. With this process, and employing crude pilot plant equipment, 90-95 percent glycol recovery has resulted. At present, this concern is working on a spray drying process which will be simpler and require less equipment.

Esterification and conversion studies have shown that by pyrolysis of glycol diacetate in a stainless steel tube at 575 deg. C., with a contact time of about one second, 80 percent of the theoretical yield of butadiene is obtained. The patent claims a yield of 90 percent, but as yet this has not been attained. The crude butadiene thus obtained analyzes 98.5 percent purity.

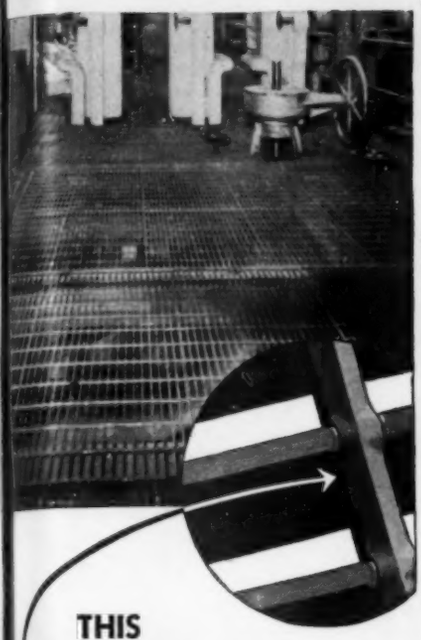
In summing up, a 15.0 lb. yield with 95 percent recovery and 80 percent conversion is equivalent to 6.85 lb. of butadiene per bushel of grain. This figure is capable of improvement.

After careful engineering studies, the engineers of Seagram have found that a plant which can produce 20,000 tons of butadiene by the 2,3-butylene glycol process would cost $4,263,500, or $213 per ton capacity. The cost of production is estimated at 18.2 cents per lb. from corn, at 80 cents per bushel of 56 lb.

Paul J. Kalachov, Technical Counselor, Joseph E. Seagram & Sons, Inc., Louisville, Ky., before the Ninth Annual National Farm Chemurgic Conference, Chicago, Ill., March 25, 1943.

CHEMICAL MANPOWER IN THE WAR EFFORT

MANY STUDIES have been made for the purpose of determining the needs for chemists and chemical engineers in our war production program. It has not been difficult to demonstrate these needs. The American Chemical Society has made a



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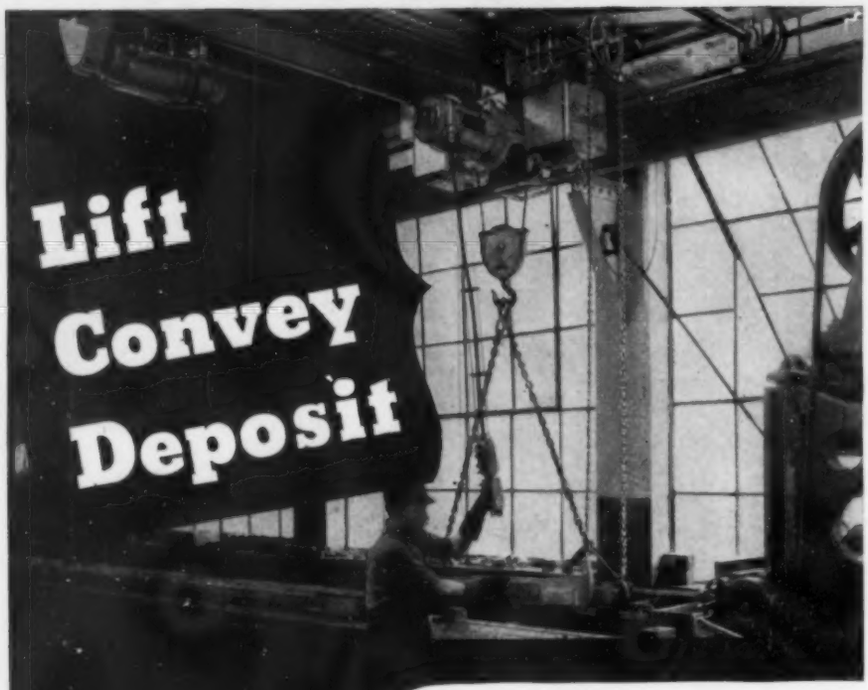
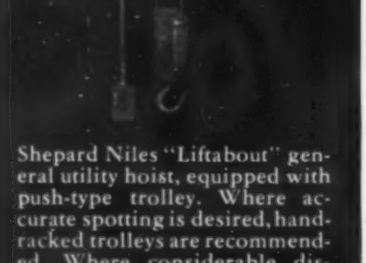


Shepard Niles "Liftabout" general utility hoist, equipped with push-type trolley. Where accurate spotting is desired, hand-racked trolleys are recommended. Where considerable distance and fast travel speed is needed, a motor-driven trolley is an economical investment.



Motor-driven, Close Clearance or Low Head Room Hoist. Available with either push-type, hand-racked or motor-driven trolleys.

THE purpose of a hoist is to lift, convey, and deposit materials. Sounds simple, doesn't it? However, in choosing the right type of hoist for any given job, many conditions must be given thorough study.

Weights of loads, speed and distance of travel, both vertical and horizontal, as well as frequency of use are among the many factors which must first be considered for maximum hoist efficiency.

Perhaps your materials handling problem is one which requires complete coverage of a large area. If so, a Single Beam Hoist, in conjunction with a Single Beam Crane, shown above, will do the job. Or, if your requirements are for lifting only, a bolt-suspended hoist is the answer.

Whatever *your* materials handling problem, you may rest assured that Shepard Niles has the correct equipment for you. Put your problem up to a Shepard Niles representative.

Write for Bulletin No. 127.

SHEPARD NILES
CRANE & HOIST CORP.

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survey which shows that 263 establishments need 1,618 chemists and chemical engineers.

A recent study by the Illinois Institute of Technology showed that companies, all engaged in war industries needed 16,940 additional engineers and chemists during 1943. Another survey of many professional and technical occupations has been made by the U. S. Employment Service. This survey determined the current employment and anticipated hires of 526 companies. The results for chemists, metallurgists, and chemical engineers are given in the accompanying table.

	Current Employment	Anticipated Hires Minus Layoff	Percent of Current Employment
Chemist, biological	222	57	38.8
Chemist, organic	1,687	530	32.6
Chemist, inorganic and physical	704	223	32.6
Metallurgist	508	262	51.9
Chemical engineer	928	298	32.6

The U. S. Employment Service completed during March the most extensive survey of shortages in critical professional and technical fields yet attempted. When the results of this survey are tabulated we shall have available information on the needs of some 16,000 establishments.

There is also a decided shortage in available laboratory technicians and chemical assistants. The best available data show a need for 78.2 percent additional employees of this kind, figured on the basis of current employment.

Fowler V. Harper, Deputy Chairman War Manpower Commission, Washington, D. C., at the 105th meeting of the American Chemical Society, Detroit, Mich., April 14, 1943.

RADIUM PRODUCTION

ALL radium extraction processes have a common aim; the preparation of mixed barium and radium chlorides (or bromides) free from all impurities, from which the radium salt is separated by fractional crystallization. When the mixed chlorides have been finally purified, the ratio of barium to radium is about $1:5\times10^{-6}$. A further concentration of 100,000 is therefore necessary before a commercially suitable product is obtained. The mixed chlorides are dissolved in hot water and, on cooling, crystals separate out containing about four times as much radium salt as does the mother liquor. Many hundreds of operations are necessary before the final Ra:Ba ratio of 9:1 is obtained.

Although actual separation of mixed barium and radium salts at the Great Bear Lake Canadian refinery follows the lines originally laid down by Mme. Curie, the high silver content presents not only a technical difficulty, but also an important economic factor. In conjunction with the Canadian Mines Branch at Ottawa, Marcel Pochon, chief chemical engineer at the Port Hope refinery, evolved a process which removed radium while allowing silver to accumulate in the residues for eventual smelting. The

ficulties arose in filtering operations, and in 1935 a new process was put into operation, where by the silver is removed at an early stage.

Great Bear Lake lies some 21 miles south of the Artic Circle, and since the nearest railroad is 1,450 miles distant it would, but for air transport, be virtually cut off from the outside world for all but three or four months in the year. Freight charges naturally play an important part in the cost of production of the refined products, and consequently great care is taken to see that only ore of the highest assay values is produced for shipment to the refinery at Port Hope, Ontario, some 4,000 miles distant.

Owing to the presence of carbonates and sulphides which give rise to a great deal of frothing, the ore is subjected to a preliminary roasting at about 600 deg. C. when, besides decomposing carbonates and sulphides, some arsenic and antimony are volatilised. As the silver is present in the native form, a further roast at 800 deg. C. for 4 hrs. with 5-10 percent sodium chloride is necessary to convert it into the chloride. After discharge and cooling, the chloridised product is ground to —40 mesh, ready for the wet extraction process.

Stoneware vessels sufficiently large to take care of 420 lb. of roasted ore are used, and H_2SO_4 diluted with an equal quantity of water is employed to remove the uranium. The operation takes about 6 hours, and during the second hour 5 percent $NaNO_2$, based on the uranium content, is added to ensure oxidation of the latter. As the ore does not contain sufficient barium to act as a carrier for the radium, 0.5 percent of $BaCl_2$ is added.

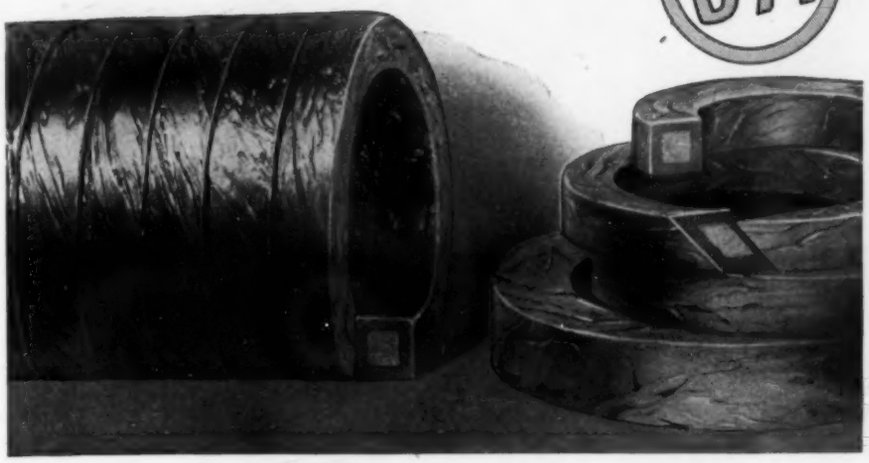
At the end of the reaction a little HCl is added to remove any soluble silver. The uranium sulphate solution is filtered off through stoneware suction filters, while the insoluble residue containing barium, radium, silver, silica, lead and some calcium is assayed for silver, after which the requisite amount of sodium hyposulphite solution is added, leaching taking place in a closed steel drum which is agitated for three hours. The mix is filtered and the silver precipitated from the filtrate by means of sodium sulphite, and after filtration and drying is shipped to United States refiners.

The hyposulphite leach contains 12-13 percent $PbSO_4$, which is 99 percent removed by boiling for 1.5 hours with NaOH in open steel kettles and filtering. Some silica is removed at the same time, and the rest is taken out by boiling for 6 hours in a low-pressure autoclave with Na_2CO_3 followed, after filtration, by boiling with strong HCl. The cake contains only a very small amount of radium, the filtrate consisting of mixed radium and barium chlorides. This liquor is agitated in stoneware vessels, with a slight excess of H_2SO_4 for 6 hours. The precipitate so formed represents about 1.5 percent by weight of the original ore. Final residues are maintained at 3 mg. radium and 25 oz. silver per ton, which represents extractions of more than 90 and 95 percent respectively.

Final separation of barium and radium

OK for gasoline . . . DURAMETALLIC packing

TYPE B-71



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DURAMETALLIC Type B-71 . . . in use by first rate refineries . . . designed especially for gasoline, crude oil and petroleum derivatives in refinery and pipeline service.

B-71 FEATURES

A. High grade resilient core

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MEMO ★ Investigate possibilities of use of t-Butyl Hydroperoxide with special activating chemicals as polymerizing agent

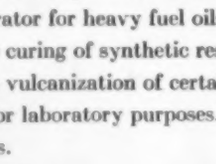
Commercial t-BUTYL HYDROPEROXIDE

A new organic alkyl peroxide which offers extremely interesting commercial possibilities

Commercial *t*-Butyl Hydroperoxide is standardized at a concentration of 60% (10.66% available oxygen) — and appears ideally adapted for use . . .

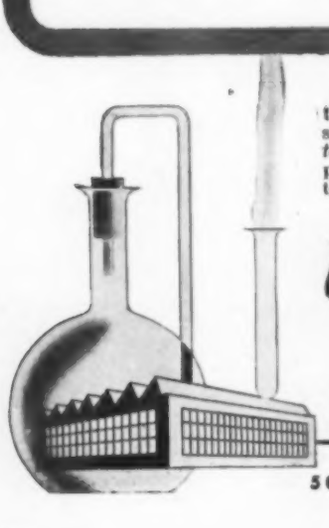
- As a catalytic agent in one or two phase polymerizations.
- As a bleaching agent for cotton, wool and other fabrics.
- As a drying accelerator in oils, paints, varnishes, etc.
- As a combustion accelerator for heavy fuel oils used in diesel engines.
- As an accelerator in the curing of synthetic resins.
- As an accelerator in the vulcanization of certain synthetic rubbers.
- As an oxidation agent for laboratory purposes.
- For numerous other uses.

t-BUTYL HYDROPEROXIDE*



- Is an unusually stable liquid with an active oxygen content of 17.8% at 100% concentration. However, by the use of the proper activator the desired amount of oxygen can be released.
- Can be handled and shipped in large quantities without danger of explosion from shock.
- Is soluble in many common organic solvents such as alcohol, ether, ketones in general, esters, aromatics and petroleums.
- Is slightly soluble in water.
- Is fairly stable in the presence of various alkalis and acids.

★ U.S. PATS. 2176407 AND 2223807



Our Laboratories and Research Staff will be glad to work with your organization and will be pleased to suggest destabilizers to be used in connection with *t*-Butyl Hydroperoxide specifically adapted to your present problems. Samples sent upon request. Write today to . . .

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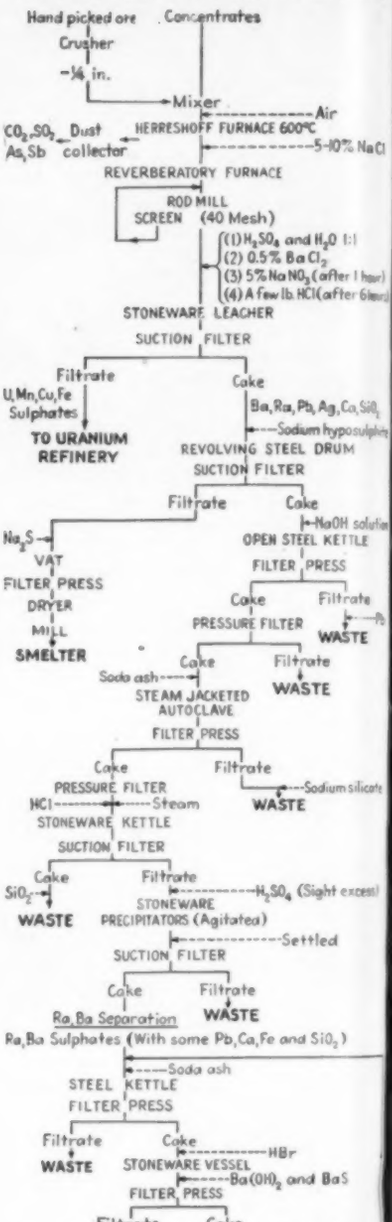
PORT HOPE (ONTARIO) RADIUM REFINERY



is obtained by first converting chloride into carbonates. These are then dissolved in HBr and lead, iron, copper, etc., are removed by treatment with Ba(OH) and barium sulphite, the precipitates being treated with H_2SO_4, Na_2CO_3 and HBr and the purified liquor added to the main bromide solution. The final residue is passed back to the original leachers.

Fractional crystallization begins with the Ra:Ba ratio at 1:400,000 which after 10 crystallizations is reduced to 1:600. Crystallization is continued until the final ratio is 9:1.

Up to final fractional crystallization the mixed chlorides, wood or stoneware vessels and filters predominate. During is used to a limited extent for pumps and where no acidic liquors are being handled, steel is suitable. The fractional crystallization is really a laboratory operation on a large scale, and consequently the apparatus is made for the most part of porcelain.

Protection of workers during the later stages of fractional crystallization is afforded by use of rubber gloves and screens of lead and glass. A recent electrical method may have applications in the factory. The process consists of relying on electro-magnetic diversion of rays from their normal paths, whereby positive particles are absorbed on a negatively charged magnetic pole and negative particles on a positive pole. The operator can station himself in the field of minimal radiation.

E. F. Mactaggart, before a joint meeting of the Chemical Engineering Group and the Institution of Chemical Engineers in London, England, Oct. 15, 1942, and reprinted in *The Industrial Chemist*, Nov. 1942.

DRIP-POINT GRID TOWER PACKINGS: GAS-FILM TRANSFER COEFFICIENTS

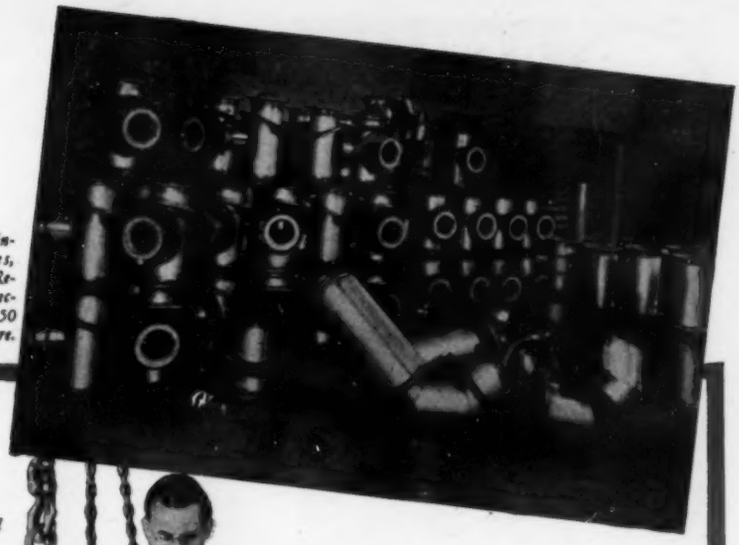
MEASUREMENTS of the rate of absorption of ammonia in water have been made using the apparatus and the nine industrial tower packings described in a previous paper (Am. Inst. Chem. Engrs. *Trans.* **38,** 387-409). In tests at a constant water rate of 3,000 lb./(hr.) (sq. ft.) the gas rates were varied from 100 to 1,100 lb./(hr.) (sq.ft.) In tests at a constant gas rate of 500 lb./(hr.) (sq. ft.) the water rates ranged from 1,800 to 18,000 lb./(hr.) (sq.ft.).

The transfer coefficients, $K_G a$ increased with increases of either the gas rate or the water rate, and in most cases could be represented by straight lines on a log-log plot. The coefficient varied greatly with the packing; typical values, expressed as lb. moles/(hr.) (cu.ft.) (atm.), as measured at $G=500$ and $L=3000$ *lb./(hr.) (sq.ft.)* are as follows: 1 in. Raschig rings, 23.0; 1 in. Berl saddles, 19.8; wood grids with ½ in. legs, 13.0; No. 6295 drip-point grid tile, 12.0; 3 in. x 3 in. triple-spiral tile, 11.8; No. 6146 and 6897 drip-point grid tile, 9.8 and 9.0, respectively; wood grids without legs, 8.4; 3 in. x 3 in. single-spiral tile, 8.2; and 3 in. x 3 in. partition tile, 3.8.

Additional measurements of oxygen desorption rates gave values of the liquid-film coefficient, $K_L a$, which are believed to be more accurate than those previously reported for these packings (Am. Inst. Chem. Engrs. *Trans.* **38,** 410-434, 1942). With this knowledge of $k_L a$ it was possible to calculate the gas-film coefficient, $K_G a$, and thus get a measure of the resistance to mass transfer which is due to each film. For most of the tests, at least 85 percent of the total resistance was due to the gas film.

Variation of $K_G a$ with gas rate ranged from the 0.49 to the 0.76 power of the gas rate, depending on the packing. Similarly, the variation of $k_G a$ ranged from the 0.54 to the 0.83 power of the gas rate, for the packings tested. This indicates that a single value, such as 0.8, cannot be taken for all packings, and that the exponent for any packing may depend on the relative importance of laminar diffusion and transfer due to gas turbulence.

Transfer rates are also expressed in terms of the height for a transfer unit, $(H.T.U.)_{OG}$. A plot of pressure drop



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Capacities from 15 to 3000 G.P.M. Secondary or Combination Heads in addition to standard heads cover a wide scope of requirements.

List of owners of Deming Deep Well Turbine Pumps looks like a "Blue Book of American Industry". Write for a copy. For specific details on these pumps, Bulletin 4700-8 is available. Ask for it.

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Numerous requirements of the Chemical Industry are met successfully by the extensive line of Deming Centrifugal Pumps. Many exclusive features, including non-clogging, dynamically balanced impeller. Special bulletins on various types of these pumps are available.

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per transfer unit, which is proportional to the pressure drop through a packed tower for a given duty, shows a 28-fold variation between the lowest, No. 6146 drip-point grid tile, and the highest, 1 in. Raschig rings. For many of the packings, the pressure drop per transfer unit shows a minimum at a water rate of about 5000 lb./(hr.) (sq. ft.)

M. C. Molstad, University of Pennsylvania, Philadelphia, Pa., J. F. McKinney, Sun Oil Co., Marcus Hook, Pa., and R. G. Abbey, General Refractories Co., Philadelphia, Pa. before the American Institute of Chemical Engineers, New York, N. Y., May 10–11, 1943.

SYNTHETIC AND NATURAL RUBBER

THE RUBBER Reserve Co. has provided funds whereby production of wild rubber in South America is being increased, and in 1944 the estimated production will be 70,000 long tons. We will, however, receive only that which remains after the requirements of South American factories have been met.

Cost per pound of producing synthetic rubber varies according to the type: 50 cents per pound for Buna S; 70 cents for Hycar; 41 cents for Polybutene; 65 cents for Neoprene; 70 cents for Buna N; and 50 cents for Thiokol. The price of all the synthetics will undoubtedly be reduced, particularly when production volume increases. It is expected that Buna S can be produced at 15-20 cents per pound, and Butyl from 10-15 cents per pound.

Buna S is best in tires and tubes. Guayule is added to Buna S to improve its quality. Buna N is best in products where oil resistance is important, and Thiokol is outstanding for oil-resisting properties. Present indications are that Thiokol will be used for recaps. Koroseal is good for specialty goods and insulated wire and the polyvinyls are used to coat fabrics.

In normal times, consumption of natural rubber is about as follows: 76 percent for tires, tubes and repairing use; 10 percent for industrial rubber goods; 7 percent for boots and shoes; 5 percent for drug sundries, and 2 percent for miscellaneous uses.

Army uses for rubber are as follows: 2 lb. for each gas mask; 29 lb. for a pneumatic raft; 500 lb. for an Army truck; 1,200 lb. for each bullet-proof gas tank for "Flying Fortresses"; 1,730 lb. for a medium tank; 3,200 lb. for a ten-ton pontoon bridge; and 150,000 lb. for a 35,000-ton battleship.

If the war lasts two or three years we will have a well-established synthetic rubber industry. We may expect greatly improved polymers. The price competition between natural and synthetic rubbers will be keen, and will depend finally upon the wage for which the coolie will be willing to work after the war. There will probably be an overproduction of rubbers, both natural and synthetic, which will have to be handled by devising new uses for rubber.

Howard I. Cramer, Sharples Chemicals Corp., before the New York Chapter of the American Institute of Chemists, New York, N. Y., Jan. 29, 1943.

This Tribute

to the men of the Chemical Industry appears in

Time and *Fortune*

We, who know so well your magnificent accomplishments in peace as in war, are gratified to tell millions of Americans about the work of the Chemical Industry.

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Lighter, stronger helmet
Better ammunition — shooting faster, farther
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Synthetic rubber soles

The Chemical Industry helps send our American men to war, the best armed in the world. From the bullet-proof nose of our bombers to the welded hull of our ships, the managers, technicians, and workers of our chemical plants give superiority to American fighting-equipment.

Chemicals are "hard to handle." General American Transportation learned this through years of team-work with the industry. Now, our specialized tank cars carry metal-eating acids, alkalies, and vital chemical compounds—with speed and safety that can mean the margin of victory.

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A SYMBOL OF INTEGRITY FOR OVER 40 YEARS

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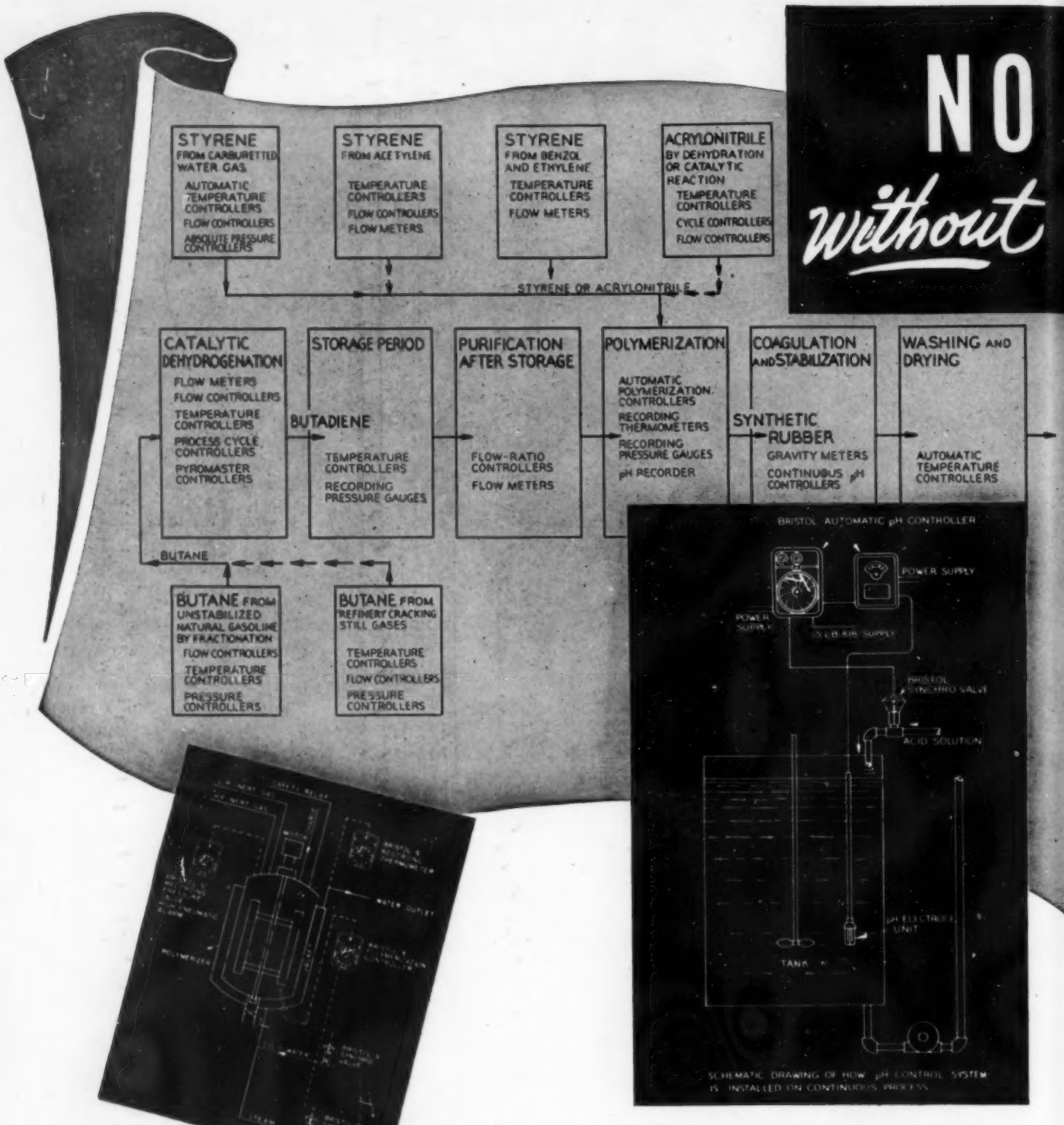
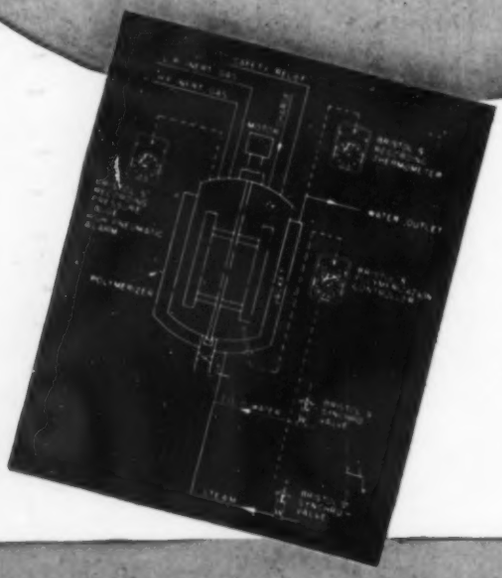




BRISTOL'S POLYMERIZATION CONTROLLER

Development of a *single* instrument of *simple* construction is one result of Bristol's extensive experience and research in synthetic rubber instrument problems. Heating and cooling under reaction conditions where widely varying operating factors and quantities of cooling medium are required, are taken care of with temperature held rigidly at the correct control point.

The chart shows a typical Bristol Control System for polymerizer reaction vessels — essential for polymerization of butadiene and copolymers such as styrene or acrylonitrile.

Write for Bulletin 103 on Bristol Controls for Synthetic Rubber Production.

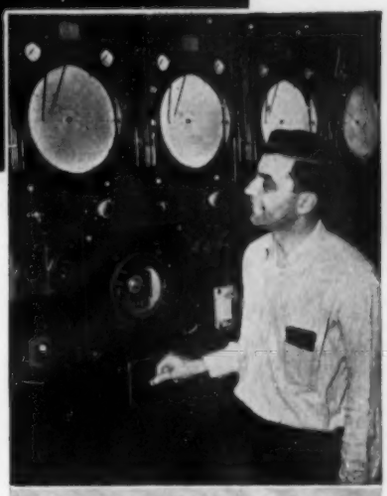
BECKMAN ELECTRODES USED IN ALL BRISTOL pH RECORDER-CONTROLLERS

The schematic drawing illustrated above shows a typical method of applying Bristol's Automatic pH Controller to a continuous process. Many installations similar to this one are in successful operation throughout the process industries.

Beckman Shielded Glass and Calomel Electrodes are used with Bristol pH Recorders and Automatic Controllers.

Beckman Indicating pH Instruments and Bristol pH Controllers with Beckman electrodes have been specified in every synthetic rubber plant contracted for under the government program.

SYNTHETIC RUBBER
AUTOMATIC CONTROL



Pushing a tiny button, the operator of the control board activates the Bristol instruments which started production of synthetic rubber in the United States Rubber Company's New England plant.

BRISTOL'S LONG EXPERIENCE WITH CHEMICAL PROCESS INSTRUMENTS NOW HELPS SPEED SYNTHETIC RUBBER PROGRAMS....

The synthetic rubber program, with all its vast implications in the present emergency, is essentially dependent on automatic controls — which *alone* can insure that the correct procedure is repeated with the same precision day after day.

The original work done by Bristol engineers in collaboration with the designers of synthetic rubber plants has resulted in the development of a series of automatic control instruments for temperature, flow, flow ratio, pressure, pH value, and time cycle specifically designed for the problems involved. These instruments have been correctly applied and are now in use in plants producing synthetic rubber and raw materials for synthetic rubber.

The work done by Bristol engineers in producing instruments for the synthetic rubber program is typical of what has been done in many other industries, particularly in the chemical industry.

Installations have been made, particularly for catalytic dehydrogenation and polymerization. Bristol pH controllers, with Beckman shielded glass or calomel electrodes, are also in use in coagulation and stabilization processes. Several installations have already been proven in action over a considerable period of time.

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NEWS FROM ABROAD

GREAT BRITAIN INVESTIGATES POSSIBILITIES OF UNDERGROUND GASIFICATION OF COAL

Special Correspondence

WARTIME developments have accentuated the importance of coal, Britain's foremost industrial raw material. Unfortunately coal has too long been regarded as nothing but a fuel for households and industry, and its utilization as an industrial raw material and as a starting point for various chemical processes has been neglected as long as overseas supplies of oils arrived in unlimited quantities. Moreover, there are obvious limits to an expansion of the coal mining output. Experience has shown that an annual production of substantially more than 200 million long tons cannot be achieved with the present labor force, and during the last winter it became necessary to release miners from the Army in order to avoid a shortage of coal, which in the end was overcome chiefly thanks to the mild weather. The labor difficulties have given an impetus to investigations which have the underground gasification of coal for their object. Efforts in this direction which have been undertaken in the U.S.A. and U.S.S.R. have been closely studied, and a small experiment is being carried out in Scotland. None of the arguments which on a previous occasion were put forward against underground coal gasification in the British Isles appear incontestable. It was said that the British coal seams are too deep for gasification, but little evidence has been adduced to prove this, and given the coal seams are sufficiently large, this factor should not affect the economic calculation. To judge from Russian experience it seems to depend largely on the cost of the oxygen required whether the gasification can be carried out on a remunerative basis.

Selective Use of Coal

As the total supply of coals is strictly limited, it is more important than ever that the different types of coal are used where they give best results. In particular, coking coals must be used where their specific properties are of real use. Moreover, it is necessary to

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make full use of byproducts and give special encouragement to plants where valuable byproducts are produced, while plants which can be run on either crude coal or semi-manufactured fuels should use the latter only if they cannot be used to better advantage anywhere else. Thus it has been argued that the hydrogenation plant should revert to coal as a raw material and leave creosote for other works which derive special benefits from using this byproduct. Planning might go even further. A Tar Acids Export Co., consisting of producers and exporters is handling the shipments from Great Britain to U.S.A. of the products in question, while the U. S. Government has appointed the Defense Supplies Corp. to buy all the cresylic acid which is required from the United Kingdom. Thus British production and consumption of coal-tar products and other coal derivatives should be made to fit in with U. S. production plans. All experts agree that striking advances have been made in the production of fuel oils and other liquid products from coal. It is stated that some 600,000 long tons of coal-tar are being produced annually in Great Britain, and more is needed. Naturally the representatives of the various organizations interested in working up coal into liquid and gaseous products differ in their views.

Liquid Fuels

On behalf of the low-temperature carbonization industry it is stated that there has been a large increase in the quantity of alternative liquid fuels produced from low temperature oils, although the quantity is said to be only about half of what it could be. One company alone is reported to supply diesel oil and gasoline for 500,000 miles of heavy traffic per week, and the operating results are perfectly satisfactory and open the prospect of an assured future for these fuels. Diesel oil made from coal can be produced with any desired cetene number between 50 and 80.

As for byproducts which are obtained in this and other processes a scheme for the production and supply of high-boiling tar acids for disinfectants has been drawn up in consultation with the official controller to cover a full year. The production, distribution and use of road tars are being carried out by a combination of the producers working in conjunction with the coal-tar controller. New products have been evolved to take the place of bitumen. Besides, pale and dark resinous bases are now being produced in the British Isles for the paint industry, and many hundreds tons of these resins derived from coal are used for camouflage and other purposes. The results obtained with pitch as a substitute for asphaltic bitumen justify in the view of the Association of Tar Distillers further investigations from a long-term point of view to secure the maximum use of indigenous materials among which pitch has long been neglected and is still being produced in rather larger quantities than can easily be placed on the market.

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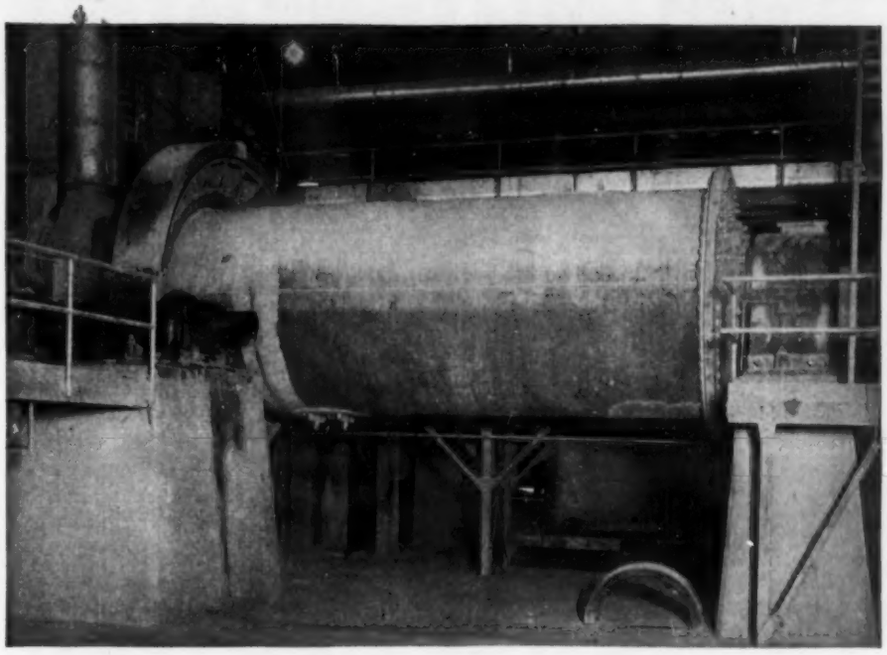

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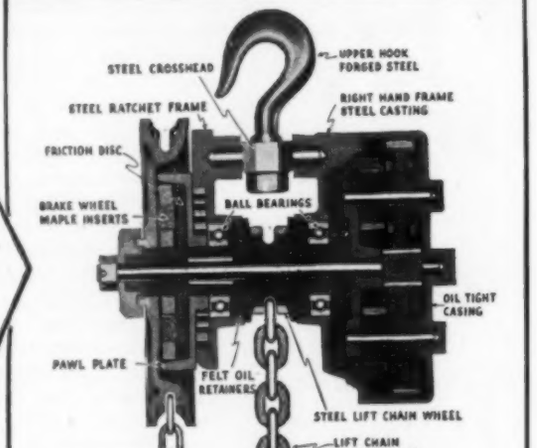

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Problems of Gas Industry

The gas industry has approached the problem from a somewhat different angle. Here again, however, the long-term development is receiving due attention. The chief requirements in that sector of the fuel industry with which the gasworks are concerned are said to be: (1) To be able to deal with a much larger range of coals and not to depend upon a coking coal of low ash contents; (2) in making gas, to produce such a proportion of coke as may be sold advantageously; (3) to produce a tar that can be readily hydrogenated to liquid fuels required for internal combustion engines; (4) to carry out the process of coal treatment in a vessel self-heated internally, thus avoiding external heating with its low efficiency and the production of waste products of combustion. The Gas Research Board has shown particular interest for the production of methane, which is the simplest gas resulting from the combination of carbon and hydrogen, has a calorific value nearly twice as high as coal gas, and can be handled, stored and distributed at a low cost. As it liberates heat during its formation and reactions, it can be self-supporting in the sense that it needs no outside fuel, but its production requires in practice application of pressure at 1000° C, which was not until recently feasible. It has now been found possible to convert coal into methane on the laboratory scale by a reaction under pressure of hydrogen with the coal. This process depends upon the production of hydrogen at a high thermal efficiency, which is accomplished by passing oxygen and steam through carbon-containing fuel at a high pressure (up to 50 atmospheres). It is thought that about half the carbon could thus be converted to methane, while the other half would be required for the manufacture of the hydrogen needed to produce methane and to dilute the final gas to the usual calorific value.

This work of the Gas Research Board and the experiments of official and private stations reflect the willingness on the part of British research organizations to try out new processes, which until a few years ago was missing because then all these experiments seemed to be futile because of the ease of importing organic chemicals and liquid fuels in the form in which they were desired at very low cost. Today the position is different in more than one respect. The dangers and difficulties of all imports at the present time, the increased demands of consumers, the development of entirely new fields of application for organic chemicals in the field of plastics and elsewhere have contributed to draw attention to the possibilities existing in this field. The main influence, however, is the definite impression that, just as in the United States a complex and efficient chemical industry has been built up on petroleum, an equally comprehensive chemical production can be based on Britain's prime raw material, coal if the proper initiative is found for the effort.

German Plants

It is interesting to note that similar developments have been going on in Germany, where of course large-scale experiments and investments were made long before the war. It seems that in the light of war experience the enthusiasm for big hydrogenation plants has cooled down somewhat, partly for reasons entirely due to the war—the vulnerability of these big plants in air raids—but also for economic reasons. Smaller plants—of the Fischer-Tropsch type, for instance—seem to have been found more effective and adaptable, and the ordinary coke-oven industry also seems to receive greater attention now, even though the shortage of coking coals is very marked in Germany. The gas industry has developed big interconnected pipeline systems in the principal provinces, and efforts have been made to utilize recent advances in the chemical treatment of coal in countries under German control. Most of this work is of an exploratory character, but insofar as there have been changes, they seem to have been in the direction of the less spectacular and longer established coke-oven and synthetic industries. Germany has based its synthetic rubber industry on coal, but looking closer it will be found that much of the work carried out in Germany was concerned with lignite rather than coal and that the production of solid byproduct, for use as generator fuel and other purposes, was of considerable importance. These considerations are of no interest in Great Britain where large quantities of excellent coal are available, while some important organic chemical industries were still completely missing at the beginning of the war. The production of calcium carbide and acetylene which has only commenced in the comparatively recent past and the manufacture of synthetic rubber which has not yet been undertaken at all are examples.

In spite of the neglect of these chemical opportunities before the war it can be said that the organic chemical industries in Great Britain have been able to make a very valuable contribution to the war effort. In the field of explosives, at any rate, the country is now much better equipped than it was in the first world war, and it may be hoped that the British chemical industry will emerge from this war with a more diversified and more progressive organic chemical industry.

EIRE NOW SELF-SUFFICIENT IN FORMALDEHYDE

Eire's production of formaldehyde is now adequate to meet present domestic requirements, a British chemical magazine reports.

The Irish Alcohol Factory at Cooley, Dundalk, County Louth, produced more than 8,000 gallons of formaldehyde during the past year. Methanol, the raw material, is being imported in considerable quantities from the United Kingdom.

Formaldehyde is use in Eire chiefly for large-scale disinfection and soil sterilization for tomato growing.

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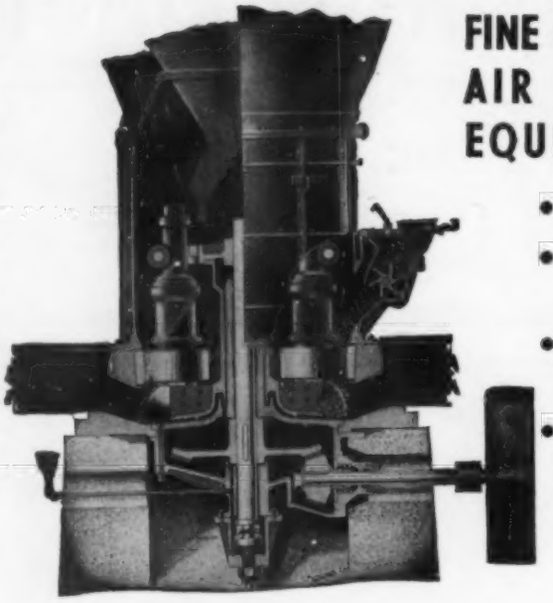

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INDIA USES NATIVE MATERIALS TO MANUFACTURE CHEMICALS

The Indian Council of Scientific and Industrial Research has completed a number of studies and its findings have been made available for commercial and war purposes, say press reports from India.

Many of the new-found products utilize domestic raw materials or materials ordinarily considered as waste; they have often proved valuable replacements for imported goods now difficult to obtain. Substitutes for cork and window glass are considered of particular importance.

Air-foam solution, colored smokes, antigas cloth, seaming varnish, and identity disks have been useful for military or civil defense needs. Almost 100,000 gallons of air-foam solution have been made by Calcutta and Delhi firms, and additional quantities will soon be produced by several oil companies. A number of articles for the British and American Air Forces have also been developed.

The Mysore Government is manufacturing urea, of great importance in the plastics industry, and formaldehyde and phosphorus have been made at the Indian Institute of Science, Bangalore. Pilot plants for making titanium dioxide are also in operation.

AUSTRALIA PRODUCES WIDER RANGE OF CHEMICALS

Australia's growing chemical industry is now turning out a number of products which previously were imported, according to reports reaching the Department of Commerce.

Salicylic acid, aniline, ethyl aniline, phthalic esters, beta naphthol, acetylsalicylic acid, and other chemicals, as well as phthalic anhydride and synthetic phenol, are being made in increasing quantities. With the production of phenol, Australia enters the field of plastics.

The manufacturer of power alcohol has increased greatly since the beginning of war, and demands for it and other products derived from molasses now take the total molasses output. Large quantities of raw sugar are also being used in the production of alcohol and chemicals.

The output of adhesives of vegetable and animal origin is sufficient to meet demands. Glue production can take care of domestic requirements, and vegetable adhesives are being made from locally grown starches, eliminating the use of imported materials.

BRAZIL DEVELOPS DEPOSIT OF BAUXITE

Progress is reported in the exploitation of the large deposits of bauxite and the development of an aluminum industry in Brazil, says a foreign technical journal. Plants are being constructed in Ouro Preto, Minas Gerais. One will consume about 10,000 to 12,000 tons of bauxite annually and produce between 5,000 and 6,000 tons of aluminum. The other will produce metallic aluminum; initial production will be 2,000 tons a year, or about 20 percent more than Brazil's normal consumption. Power will be furnished by a hydroelectric power plant with a capacity of 14,500 horsepower.

ARGENTINE OILSEED CROPS BELOW 1942 TOTALS

Argentine edible-oil production for 1943 is estimated at only 112,000 metric tons, states an article appearing in a publication of the Chamber of Commerce of the United States of America in the Argentine Republic. Edible-oil output during 1943 from the principal oilseeds is forecast as follows: Sunflower-seed oil, 74,000 metric tons; peanut oil, 21,000 metric tons; cottonseed oil, 14,000 tons; rapeseed oil, 3,000 tons.

This sharp decline from the estimated 200,000 metric tons produced in 1942 is attributed to the intense drought which afflicted Argentina in recent months, and which caused a reduction not only in area planted but also in yield per acre. The area planted to sunflowers for 1942–43 is estimated at 674,000 hectares (1 hectare = 2.47 acres), a drop of 10 percent from the 1941–42 area of 750,000 hectares, whereas the 1942–43 yield of sunflower seed is estimated at 350,000 metric tons, a drop of more than 53 percent from the 750,000 metric tons harvested in 1941–42.

The present high demand for sunflower-seed oil will be reflected in increased sowings for the 1943–44 season, it is stated. The total area planted is expected to reach about 1,000,000 hectares. On the basis of a harvest of 1 metric ton of seed per hectare, and an oil yield of 23 percent, production of sunflower-seed oil in 1944 would be roughly 230,000 metric tons. Production of cottonseed and rapeseed is not expected to change materially, but output of peanut oil may increase to 30,000 or 40,000 tons in 1944.

CENTRAL AMERICA INCREASES INSECTICIDE REQUIREMENTS

A noted United States plant physiologist has gone to Central America to work with agricultural authorities there in a program for stimulating production of insecticides to help meet the increasing needs of the Americas for this product.

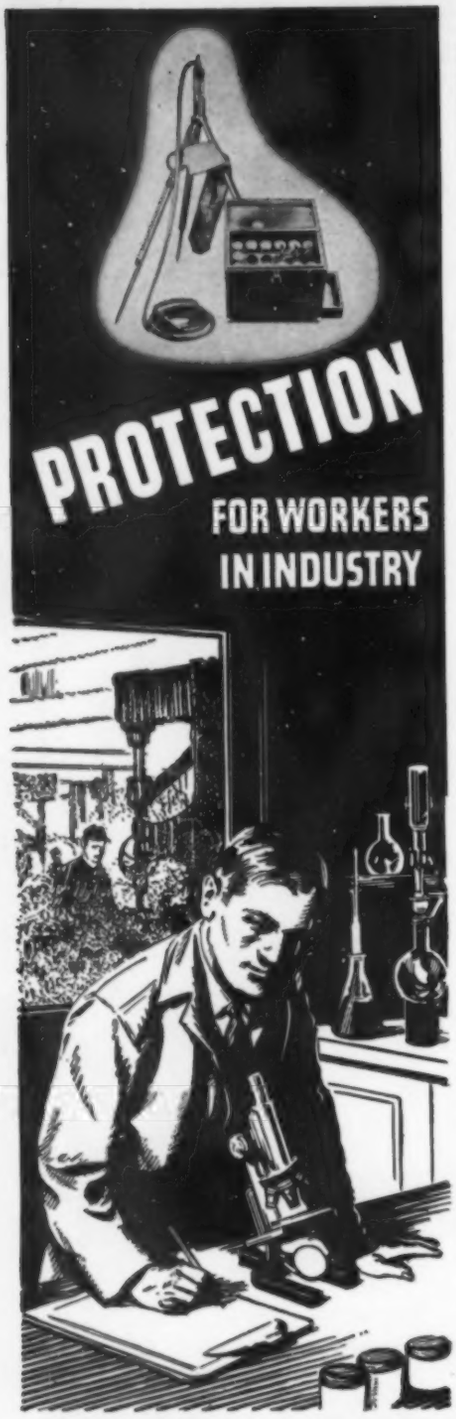
He is Dr. Rufus H. Moore, of the United States Agricultural Experiment Station in Puerto Rico. Dr. Moore has been assigned to Central America by the United States Board of Economic Warfare, which is working to develop additional sources of insecticides in the Western Hemisphere. Central America is considered well adapted for growing derris root, source of powerful insecticides useful in agriculture.

Need for insecticides has increased for the wartime food program of the Americas and to replace former supplies from the Far East.

NEW RAYON PLANT GOING UP IN SPAIN

A modern factory is being erected by a new Spanish rayon company, created last year, in collaboration with a German firm, with a capital of 75,000,000 pesetas, reports an official German news agency.

At the suggestion of German technicians, a site of nearly 500 acres has been acquired at Miranda del Ebro, and the factory is being rushed to completion by some 16,000 workers.



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ABSTRACTS FROM FOREIGN LITERATURE

SYNTHETIC RUBBER IN SOVIET RUSSIA

ALTHOUGH Soviet Russia became interested in research on synthetic rubber as early as 1918, conditions then made it impossible to take any serious action. In 1926, however, this government announced a world contest for the best work to be carried out in this field during a two-year period.

Russian chemists had already contributed a great deal to synthetic rubber research. Kondakov had shown that a rubber-like polymer could be obtained from dimethyl butadiene. Ostromyislenski proposed a number of syntheses for 1,3-butadiene and its homologs. One of these, the synthesis of 1,3-butadiene from acetaldehyde through the aldol and butylene glycol steps, has been commercially adopted by the German chemical industry in recent years. Byizov developed a method for producing 1,3-butadiene by pyrolysis of petroleum products. Lebedev, who made a study of the thermopolymerization of diethylene hydrocarbons, was the first to produce a rubber-like material by the polymerization of 1,3-butadiene. Butlerov studied the polymerization of isobutylene and much of his work has served as a foundation for the commercial production of isobutylene polymers in use today.

However, the work of Byizov and Lebedev was considered the most promising for industrial development, and in 1929 Soviet research men began work on the possible exploitation of these methods in industry. Lebedev's method, which consisted of the catalytic conversion of ethyl alcohol into 1,3-butadiene followed by the polymerization of the butadiene with metallic sodium or other catalyst, was found to be suitable for industrial use. Since 1,3-butadiene is now considered the most suitable raw material for production of synthetic rubber, the importance of Lebedev's work is obvious. His process has been developed so that now the yield of 1,3-butadiene from ethyl alcohol is more than 70 percent of the theoretical, which makes the process commercially economical. The process does not require high pressures or temperatures, no high vacuums and no special alloys for equipment.

In 1932, Soviet researchers developed a method for the continuous synthesis of vinyl acetylene from acetylene. That same year a method was developed for the synthesis of chloroprene which resulted in the commercial production of "Sovprene." Just before the present war with Germany, A. E. Favorski developed a new method for the production of an isoprene rubber which was of such importance that he received the Stalin award.

Due to government sponsorship, a large synthetic rubber industry has been established in the USSR within a period of ten to twelve years. In fact,

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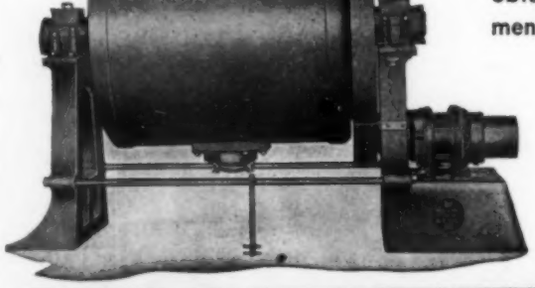

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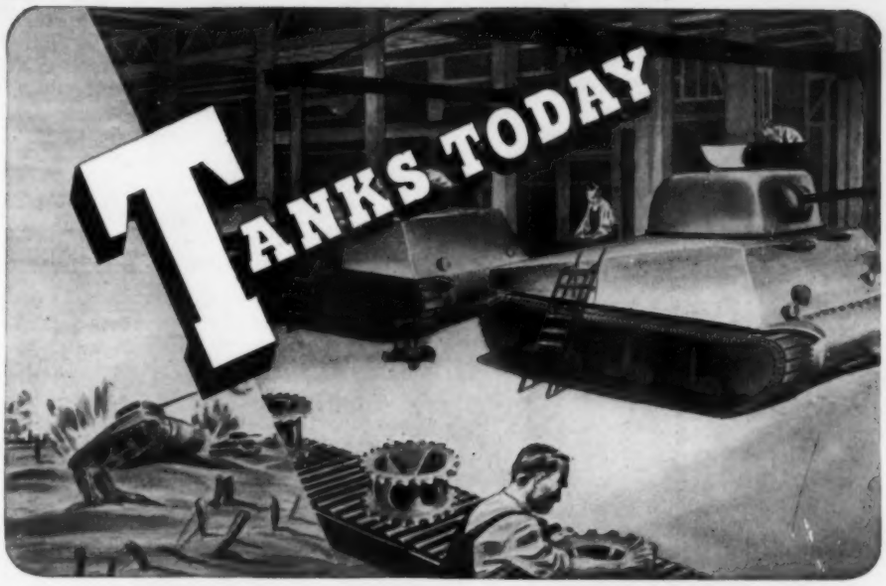

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this industry is now so large that it can satisfy a large proportion of the Soviet's rubber needs. In recent years Soviet Russia has been one of the largest consumers of rubber in the world.

Digest from "Synthetic Rubber Industry in the Soviet in the Last 25 Years," by N. I. Smirnov, *Zhurnal Prikladnoi Khimii* XV, No. 6, 373–379, 1942. (Published in Russia.)

MANGANESE AS FERTILIZER

MANGANESE is present in the soil chiefly in the form of the bicarbonate in colloidal suspension in water or as part of the living organisms. The amount of manganese that plants can take from the soil is closely related to the acidity of the soil and is very small when the soil pH value is above 6.5–7.0. Since manganese is easily washed out from highly acid soils (those with a pH value below 5.0), such soils tend to be deficient in this element. A great deal of the acid alluvial type of soils which are rich in organic matter may show such a manganese deficiency. Some red soils with a pH of more than 7.0 do not provide plants with sufficient manganese, although their total content of this element is high.

The manganese content of the most important types of soil in the S. Paulo region of Brazil have been studied, the manganese being extracted with various reagents. The most suitable reagents proved to be N/100 HNO_3 and N/100 H_2SO_4. Extraction with N/1000 HNO_3 and N/1000 H_2SO_4 proved to be most similar to actual manganese extraction by the roots of the growing coffee plant. In these cases the liquid was shaken with the soil sample for one hour and the manganese then determined colorimetrically by the ammonia-persulphate method. A Leifo-Leitz photometer with a number 530 filter was used for color comparison.

Digest from "Manganese in the Soils of the State of S. Paulo," by J. E. de Paiva Netto, *Anais de Associacao Quimica do Brasil* I, No. 3, 159–189, 1942. (Published in Brazil.)

SULPHURIC ACID FROM SLUDGES

PRACTICALLY all present industrial methods for recovery of sulphuric acid from petroleum refinery acid sludges yield a very dark colored, dilute acid which is highly contaminated with organic compounds. However, this acid can be purified by means of electrolysis. In this case, the acid passes through the electrolytic cell from the cathode to the anode and is completely freed from the organic impurities first by the reducing action and then by the oxidizing action of the electric current.

The removal of this organic matter is a purely chemical process. Up to 70 percent of it is reduced at the cathode and eliminated in the form of heavy hydrocarbons. Some 12 percent of these organic compounds is oxidized at the anode to carbon dioxide, and some 10-12 percent is mechanically removed, being brought to the surface by bubbles of the generated gas.

Dark, impure sulphuric acid was found to have about the same electro-

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For the duration the Layne Organization is, in addition to doing much urgent war work, endeavoring to keep present installations in repair and operating at top efficiency. If you wish literature, address, Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

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conductivity as pure sulphuric acid. The electrolysis proceeds most satisfactorily when the acid concentration is at about 32 percent. The most suitable type of electrolyzer was found to be one consisting of a lead cylinder, the lead serving as anode, provided with an outlet pipe at the proper height. A cylinder of acid-resistant, porous earthenware, into which a lead cathode was inserted, was placed inside the lead cylinder and provided with the necessary inlets and outlets.

Digest from "Regeneration of Sulphuric Acid from Acid Petroleum Residues," by G. M. Kooperman, *Zhurnal Prikladnoi Khimii* XV, No. 5, 319–330, 1942. (Published in Russia.)

DIESEL MOTOR FUELS

THE MOST efficient fuels for Diesel motors having a speed of 400 to 1,000 r.p.m. are those with a cetane number of 45 as determined by the Delay method and a Diesel index of 30. Motors of more than 1,000 r.p.m. require fuels with a cetane number of 50-60 and a Diesel index of 37-47.

Presence of such foreign material as water or solid particles in fuels tends to corrode the apertures of the atomizers in the engines. Since these foreign materials cannot be excluded completely, they should at least be kept at a minimum, that is, less than 0.2 percent for motors with a speed of 400 to 1,000 r.p.m. For satisfactory performance, good fuels should not have more than 0.01 to 0.02 g. of ash per 100 g. of fuel.

Diesel motor fuel should remain fluid at a temperature of less than 10 deg. C., and its ignition point should be higher than 50 deg. C. The carbon residue as determined by the Conradson method should be from 0.2 to 0.8 percent. The volatility of such oil is generally satisfactory if the other essential conditions are fulfilled. Since the sulphur causes corrosion, the oil should not contain more than 0.20 percent.

Digest from "Specifications for Fuels," *Boletin de Minas y Petroleo*, XIII, No. 11, 81–87, 1942. (Published in Mexico.)

CITRIC ACID EXPANSION IN BRAZIL

PRIOR to the war, Brazil imported more than 50 percent of its citric acid from Italy, and the remainder from Germany, Belgium, Czechoslovakia and other sources. At present, however, the imports of some 38,952 kg. are insufficient for the Brazilian market.

Brazilian Industry of Chemical Products, Ltd., of Sao Paulo, has therefore applied for a loan from the bank of Brazil for increasing its capacity for citric acid production, which amounted to some 30 tons annually by the fermentation process. The Treasurer of Exports and Imports of the Bank of Brazil has been commissioned to make the necessary arrangements with the North American authorities to assure priority for importing equipment necessary for the expansion of this firm's productive capacity.

Digest from "Production of Citric Acid in Brazil," *Boletim do Conselho Federal de Comercio, Exterior* V, No. 36, 9, 1942. (Published in Brazil.)

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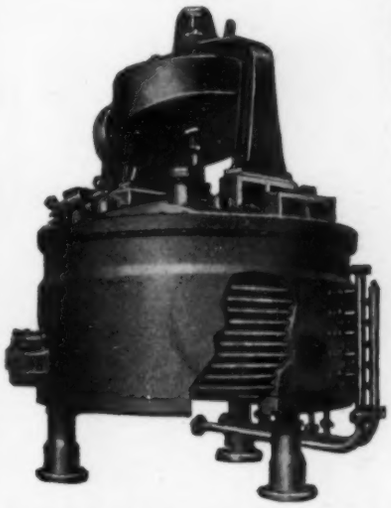

Thermocoil means steam heating coils cast in as integral parts of the walls of evaporating, distilling and drying equipment, as shown in the cut-away section of the still above.

This design makes the whole vessel wall a single heat-dispensing unit; avoids "hot spots," hence eliminates spoilage of product in process; insures precise, even temperature control, economizes on fuel through better heat transfer. The smooth inner surface makes between-batches cleaning a simple matter.

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For More Complete Details

This 54-page catalog explains the *Whys* and *Hows* of Bethlehem *Thermocoil* advantages and shows production hook-ups for nitrobenzene, aniline, simple vat dyes, cellulose nitrate and other chemical products.

It also describes other Bethlehem processing equipment—Wedge Roasters, Nitrators, Reducers, Sulphonators, Mixing Kettles, Vacuum Stills, Retorts, Autoclaves.

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EQUATIONS AND DATA

CHEMICAL ENGINEERS' MANUAL. By *D. B. Keyes* and *A. G. Deem*. Published by John Wiley and Sons, New York, N. Y. 221 pages. Price $2.50.

OBVIOUS purpose of this little 4½x6½-in. manual was to furnish chemical engineers with a pocket-size handbook of equations and data. Of its pages, 16 percent present equations of fluid flow, heat transfer, diffusional operations, and separation by filtration and settling. It is assumed by the authors that use and limitations of equations are familiar to the reader. A nomenclature list accompanies each of the sections. It is in this part of the book that the real merit of the manual is to be found. Many of the more important equations of chemical engineering are here for ready reference.

Tables of miscellaneous data constitute the balance of the volume. They are under the headings of logarithms, integrals, steam, specific heat, thermal conductivity, viscosity, vapor pressure, critical constants, safe loads, and conversion factors. The authors were hampered by space limitations and their selection of material to be published in this part of the book was probably considered in the light of the greatest usefulness to the greatest number. Hence they included such tables as logarithms, thermal conductivity of building materials, tap drill sizes and used 35 pages for presentation of data on vapor pressure. And hence they omitted tables of trigonometric functions, specific gravity, solubility, and other tables found in the older and larger handbooks.

THEORETICAL CONSIDERATIONS

THE ADSORPTION OF GASES AND VAPORS. By *Stephen Brunauer*. Published by Princeton University Press, Princeton, N. J. 511 pages. Price $7.50.

Reviewed by *Edward Ledoux*

IN THIS extensive theoretical discussion of static adsorption the author attempts to treat the subject as a science with a view to the training of scientists and technicians in colleges. Other workers have previously endeavored to provide a scientific explanation of the phenomenon, notably Langmuir, Williams-Henry, Magnus, Polanyi and Patrick-Zsigmondy, and the author discusses in detail the mathematics and mechanics of their theories comparing the resulting isotherm equations with experimental data. Although the Boer-Zwikker polarization theory can give a quantitative account of sigmoid isotherms, these theories will deal individually with one or another adsorption region only so that the author presents the multimolecular theory from which is evolved a general form of equation which can be made to represent all five general types of isotherms. This interesting unified theory has several limitations which are discussed.

The physical theories on the electrostatic nature of Van der Waals' forces are presented. These forces result from repulsion between the positive nuclei of molecules and attractions accounted for jointly by Keenan's orientation effect of dipole moments, the polarization of molecules due to Debye's induction effect and London's diffusion effect resulting from fluctuations in electric field.

Experimental results on the heat of adsorption as taken from the literature are interpreted and discussed in the light of the theories of adsorption and of Van der Waals' forces.

The state and size of the adsorbent surface as well as the pore structure playing a vital role, the author discusses experimental methods of determination, surface heterogeneity, alterations brought about by external factors or the process itself and the relation between structure and hysteresis.

Experiments indicate that the characteristics of a substance are modified when it is adsorbed; two-dimensional condensation occurs at reduced pressure, mutual polarization of the adsorbent and adsorbate is apparent and the emissivity of the adsorbent surface is changed. These effects are discussed and two-dimensional equations of state are proposed but it appears obvious that a great deal of further research is needed here.

The volume is concluded with a chapter on the kinetics of adsorption in which are given theoretical and empirical equations for the rate at which equilibrium is reached and a few pages on the adsorption of mixed vapors.

A detailed description of laboratory experimental apparatus and methods is given at the beginning of the book.

The work will be found of considerable scientific interest by those well versed in mathematics and physical-chemistry and of great help to laboratory workers investigating the field of static adsorption although it does not deal with dynamic adsorption which is the basis for practical industrial applications of the phenomenon.

QUADRILINGUAL

DICTIONARY OF SCIENCE AND TECHNOLOGY IN ENGLISH-FRENCH-GERMAN-SPANISH. By *Maxim Newmark*. Published by Philosophical Library, New York, N. Y. 386 pages. Price $6.

THIS dictionary will be useful to people who make a practice of periodically scanning the technical literature in the French, German and Spanish languages, but do not do sufficiently serious work to warrant keeping several complete and more specialized dictionaries on hand. It contains 10,000 terms in the English language and has indices to the other three languages. An extraordinarily wide field is covered, including chemistry, physics, mathematics, mechanics, woodworking, some metallurgy, radio, aeronautics, architecture, building construction, surveying, automobile industry, railroads, meteorology, navigation and photography. A number of references were used.

Although the price is not too high for a book of this type, it is regrettable that the paper is of an inferior grade and the typography somewhat careless.

RECIPE BOOK

ADHESIVES. By *Felix Braude*. Published by Chemical Publishing Co., Brooklyn, N. Y. 154 pages. Price $3.

THIS book was written primarily for the practical man to provide a handbook of formulas and instructions. The author devotes a separate section to each type of adhesive. Examples: flour pastes and starch, dextrin, casein, vegetable glues, animal glues, rubber, gums and resins, synthetics. There also are chapters on waxes and putties. Formulas are provided for general and specific uses and instructions given for mixing and application. U. S. Forest Products Laboratory data on comparative characteristics and working procedure for plywood adhesives are presented in a four page tabular analysis.

TEXTBOOK

ELEMENTARY PHYSICAL CHEMISTRY. By *Merle Randall* and *E. L. Young*. Published by Randall and Sons, Berkeley, Calif. 455 pages. Price $4.50.

Reviewed by *F. C. Nachod*

THE REVIEWER has passed this book to several of his younger associates in order to obtain as many comments and reactions as possible. Judging by the responses, the purpose of the authors, to help the student "who is attempting by himself to master the principles of chemistry," seems to have been accomplished rather well. One of the criticisms which was raised frequently was that it "is difficult and tiring to the eyes to read the photolithic print."

The gas laws are taken up in the thirteenth chapter, after such subjects as dissociation constants, hydrolysis, indicators, buffers etc. have been discussed in the preceeding chapters. This accounts for the statement in chapter two (Vaporization as a Chemical Process) that "temperature may be considered as a measure of this escaping tendency of heat."

The introduction of Heisenberg's uncertainty principle on page 156 seems to the reviewer to be outside of the

Out of the GROUND

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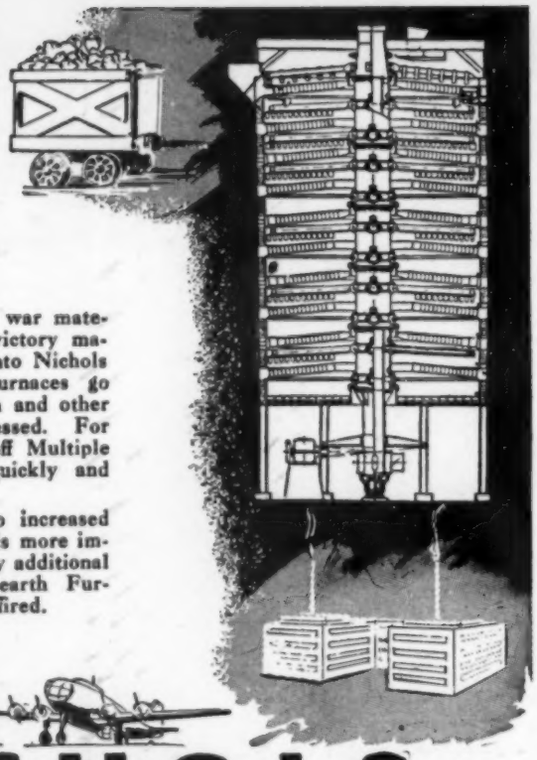
TANKS . . . GUNS AND PLANES



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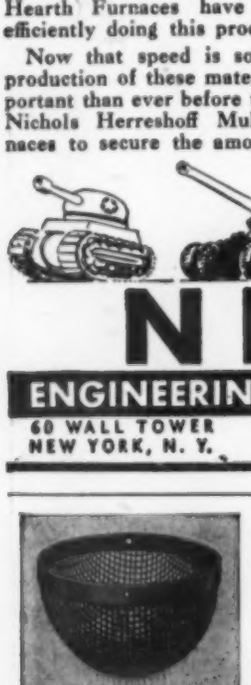

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scope of a text on *elementary* physical chemistry.

The notation used is that of Lewis and Randall's well known treatise. Numerous exercises, literature references in the text, as well as an appendix of physical constants, will prove of value to the student who uses this book.

The text is recommended for such readers who already have some knowledge of physical chemistry or for those who want to refresh their memories. However, without some background or experience in the field, the text will probably not be elementary enough. Finally, the teacher will welcome the large number of problems for class room work.

RECENT BOOKS and PAMPHLETS

Regulations for the Control of Explosives and Their Ingredients in Time of War or National Emergency. Published by Bureau of Mines, U. S. Department of the Interior, Washington, D. C. 25 pages. Pamphlet replaces all prior editions of the regulations.

Rebuilding Europe—After Victory. By *H. Motherwell.* Pamphlet No. 81, published by Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York, N. Y. 32 pages. Price 10 cents. The author declares that the new Europe can become capable of producing twice as much wealth as it could produce in 1939 if all permanent political arrangements and settlements are deferred until economic Europe is again on its feet.

Microchemical Investigations. By *Fritz Feigl* and others. Published by the Department of Agriculture, Rio de Janeiro, Brazil. 170 pages. Contains ten papers on methods (in Portuguese) for spot tests. The contents of these papers have in part been published in the United States and part are new. Brief abstracts in English are included.

Pulp and Paper Manufacture, Bibliography and United States Patents, 1942. Compiled by *C. J. West.* Published by Technical Association of the Pulp and Paper Industry, 122 E. 42nd St., New York, N. Y. 222 pages. Contains literature on pulp and paper manufacture published during the year 1942 (with references for earlier years which were not available when the 1941 edition went to press) and the U. S. Patents for 1942 of interest to the pulp and paper industry.

Effects of Cold Drawing on Mechanical Properties of Welded Steel Tubing. By *W. E. Black.* Engineering Experiment Station Bulletin Series 341. Published by University of Illinois, Urbana, Ill. 32 pages. Price 40 cents. The purpose of the investigation was to evaluate the changes that occur in the more common mechanical properties of electrically-welded S.A.E. 1010 steel tubing as a result of cold drawing in tubing.

Loss of Head in Flow of Fluids Through Various Types of One-and-one-half inch Valves. By *W. M. Lansford.* Engineering Experiment Station Bulletin Series 340. Published by the University of Illinois, Urbana, Ill. 33 pages. Price 40 cents. Tests were made on 29 brass valves of various types, namely, gate, globe, check and Y valves. The loss of head on the valve tested varied (closely) as the square of the average velocity in the pipe.

Industrial Fire Brigades Training Manual. Published by National Fire Protection Association, Boston, Mass. 184 pages. Price $1.50. Designed to meet three demands: a training manual for employees, a reference book in plants where fire brigades are already organized, and in plants which need essentials but not details of large plant fire protection organization.

Controlling Absenteeism. Bulletin issued by U. S. Department of Labor. Available from Superintendent of Documents, Washington, D. C. 57 pages. Price 10 cents. A record of war plant experience.

A Guide to the Prevention of Weight-Lifting Injuries. Special Bulletin 11. U. S. Department of Labor. Available

from Superintendent of Documents, Washington, D. C. 20 pages. Price 10 cents. Safety recommendations for weight lifting and carrying.

Safety Speeds Production. Special Bulletin 10. Issued by U. S. Department of Labor, Division of Labor Standards, Washington, D. C. 21 pages. A message addressed to supervisors.

Prepare Yourself! By *L. F. Tulcen, G. F. Porter* and *A. Houston.* Published by Scott, Foresman & Co., Chicago, Ill. 50 pages. Price 96 cents. Physics laboratory experiments with practical applications.

A Study of Glaze Stresses. By *W. C. Bell.* Engineering Experiment Station Bulletin No. 114, Ohio State University, Columbus, Ohio. 28 pages. Price 40 cents. Covers the subject of glaze fit. It can be of value to manufacturers of tile and electrical porcelains.

Wood and Its Place in the War Effort. Published by Kay Displays, Inc., 9 East 40th St., New York, N. Y. A new illustrated book for priority-hounded executives and engineers, available without charge to companies engaged in war work.

Dividends From Your Power Plant. Published by Preferred Utilities Co., Inc., 32 West 60th St., New York, N. Y. 36 pages. Gratis. Discusses such subjects as boiler efficiency, steam costs, draft and other factors affecting operation of boiler room equipment. Examples, tables and sketches help to make each topic clear.

Twenty-Third Annual Report. Published by National Bureau of Economic Research, 1819 Broadway, New York, N. Y. 32 pages. An analysis of the economic implications of war. A comparison of wartime with peace-time expansion, and a discussion of basic issues that will confront the nation on the return of peace.

Freedom From Want, a World Goal. By *E. E. Hoyt.* Pamphlet No. 80 published by Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York, N. Y. 31 pages. Price 10 cents. In attempting to measure want in exact terms the author uses as yardsticks malnutrition, death rate and illiteracy.

Blue Book, 1943. 15th edition. Published by MacNair-Dorland Co., 254 West 31st St., New York, N. Y., 212 pages. An annual buyers' guide, directory and reference volume for manufacturers and distributors of soaps, insecticides, disinfectants, polishes, cleaners and allied chemical specialties.

Flotation Tests on Fluorite Ore from Lemhi County, Idaho. By *L. S. Prater.* Pamphlet 53 published by University of Idaho, Moscow, Idaho. 7 pages. Deposits of fluorspar have been located in Lemhi County, Idaho. Object of the testing program was to determine the grade of the concentrate and the percentage recovery that could be expected from a milling operation.

Report on Oil-Engine Power Cost for 1941. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. 44 pages. Price $1.25. Authoritative and useful data on cost of operation of diesel engines. A source of information on such matters as fuel and lubricating oil consumption, and cost of supplies, maintenance, repairs, and supervision.

Pricing Primer for Maximum Price Regulation No. 188. Issued by the Consumers' Durable Goods Price Branch and Building Materials Price Branch, Office of Price Administration, Washington, D. C. 45 pages. M.P.R. 188, effective August 1, 1942, applies to manufacturers' pricing of certain building materials and consumers' durable goods named in a long specified list.

Womanpower. Published by George S. May Business Foundation, 111 So. Dearborn St., Chicago, Ill. 12 pages. A digest of facts pertaining to the employment of women in war industries.

National Emergency Steels. Published by the American Society for Metals, 301 Euclid Ave., Cleveland, Ohio. 72 pages. Price 50 cents. Pamphlet (largely from material first published in *Metal Progress*) was prepared by the American Society for Metals to aid its numerous war products advisory committees.

How to Prepare an Engineering Report. Published by the Alexander Hamilton Institute, 71 West 22rd St., New York, N. Y. 72 pages. A guide which was specially prepared for the Institute's technically trained subscribers.

Directory of Florida Manufacturers, 1943–44. Published by the Florida State

"DUST CONTROL KNOW HOW"

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Chamber of Commerce, 512 Hildebrandt Building, Jacksonville, Fla. Price $1. More than 3,000 active industrial firms are listed alphabetically, according to products manufactured, and geographically by cities and towns.

The Prevention of Butadiene-Air Explosions by the Addition of Nitrogen and Carbon Dioxide. By *G. W. Jones* and *R. E. Kennedy*. Report of investigation 3691 published by the Bureau of Mines, Department of the Interior, Washington, D. C. Gratis. Report contains tables and graphs which show how much nitrigen and carbon dioxide must be added to make varying mixtures of butadiene and air non-explosive.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, express order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

Radioactive substances. Occupational hazards to young workers: Report No. 6, 1942. Department of Labor, Publication No. 286. Price 10 cents.

Tests of Cement-Water Paints and Other Waterproofings for Unit-Masonry Walls. By Cyrus C. Fishburn and Douglas E. Parsons. Bureau of Standards, Building Materials and Structures Report BMS95. Price 15 cents.

Treading Automobile and Truck Tires. Bureau of Standards, Commercial Standard CS108-43. Mimeographed.

Analyses of Crude Oil From Some Fields in Kansas, by E. C. Lane and E. L. Garton. Bureau of Mines, Report of Investigations R. I. 3688. Mimeographed.

Comparative Yields of Light Oil, Tar, and Constituents from Carbonization Tests at 800°, 900°, and 1000° C., by C. R. Holmes and others. Bureau of Mines, Report of Investigations R. I. 3695. Mimeographed.

Structural Features of Typical American Commercial Detonators, by R. L. Grant. Bureau of Mines, Report of Investigations R. I. 3696. Mimeographed.

Analyses of Crude Oils from Some Fields in Texas, by E. C. Lane. Bureau of Mines, Report of Investigations R. I. 3699. Mimeographed.

Survey of Fuel Consumption at Refineries in 1941, by G. R. Hopkins. Bureau of Mines, Report of Investigations R. I. 3703. Mimeographed.

Mineral Production Statistics for 1942—Preliminary mimeographed statements from Bureau of Mines on: Earth pigments, bromine, blast furnace slag, natural calcium chloride, native sulfur, and lead and zinc pigments and zinc salts.

The Horse Gas Mask, M4 and M5. War Department Technical Manual, TM 3-230. Price 10 cents.

Certain Problems of Marine Transportation and Litigation. Department of State, Executive Agreement Series 282. Price 5 cents. Agreement between the United States of America and the United Kingdom of Great Britain and Northern Ireland.

Trade Agreement Between the United States and Mexico. Tariff Commission, unnumbered document. Digests of trade data with respect to products on which concessions were granted by the United States.

Wood Goes to War, by Carlile P. Winslow. Forest Products Laboratory, No. D1426. Mimeographed.

The Effect of Fire-Retardant Chemicals on Glues Used in Plywood Manufacture, by John Merle Black. Forest Products Laboratory, No. R1427. Mimeographed.

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Wood Bending in Ship Building, by E. C. Peck. Forest Products Laboratory, No. R1430. Mimeographed.

Sulfite Pulping Experiments on Sand Pine, by J. N. McGovern, and E. L. Keller. Forest Products Laboratory, No. R1429.

Peanut Growing. Department of Agriculture, Farmers' Bulletin No. 1656. Price 5 cents.

Hemp. Department of Agriculture, Farmers' Bulletin No. 1935. Price 5 cents.

Colleges and Universities, including all institutions of higher education. Educational Directory, 1942–43, Part III. Office of Education. Price 15 cents.

Educational Associations and Directories. Educational Directory, 1942-43, Part IV. Office of Education. Price 10 cents.

Public Health Service Drinking Water Standards and Manual of Recommended Water Sanitation Practice. Public Health Service, Reprint No. 2440 from the Public Health Reports. Price 10 cents. Standards adopted by the public health service September 25, 1942, for drinking and culinary water supplied by common carriers in interstate commerce.

The Toxicology of Beryllium, by Frances Hyslop and others. National Institute of Health, Bulletin No. 181. Price 15 cents.

Outline of an Industrial Hygiene Program. Public Health Service, Supplement No. 171 to the Public Health Reports. Price 5 cents.

Commercial Electric-Refrigeration Condensing Units. Bureau of Standards, Commercial Standard (Emergency) CS (E)107–43. Price 10 cents. A recorded voluntary standard of the trade.

Areas of the United States, 1940. Bureau of the Census, Sixteenth Census of the United States, 1940. Price $1.00.

Soap Specifications—Specifications for soap and detergents are being extensively revised as rapidly as possible by government specialists. For a period there were emergency specifications given these changes available in mimeographed form. Lately the amendments have been printed and are now separate colored sheets inserted in the standard federal specifications which are issued as a part of the Federal Standard Stock Catalog at 15 cents per copy.

A Simple Device for Detecting Small Concentrations of Organic Halide Gases in the Atmosphere, by G. W. Jones and R. E. Kennedy. Bureau of Mines, Report of Investigations R. I. 3697. Mimeographed.

Diesel Engines Underground. IV. Effect on Composition of Exhaust Gas of Variables Influencing Fuel Injection, by John C. Holtz and others. Bureau of Mines, Report of Investigations R. I. 3700. Mimeographed.

An Automatic Frequency-Controlled Oscillator and Amplifier for Driving Mechanical Vibrators, by E. V. Potter. Bureau of Mines, Report of Investigations R. I. 3702. Mimeographed.

Contrasts in Grinding Characteristics of Mineral Products, by Glen Dale Coe and Will H. Coghill. Bureau of Mines, Report of Investigations. R. I. 3704. Mimeographed.

Effects of Sheaths on Gaseous Products from Permissible Explosives, by E. J. Murphy and others. Bureau of Mines, Report of Investigations R. I. 3705. Mimeographed.

Some Tools and Methods Used in Cleaning Oil Wells in California, by G. B. Shea. Bureau of Mines, Report of Investigations, R. I. 3706. Mimeographed.

Determination of Tungsten in Low-Grade Ores, by H. E. Peterson and W. L. Anderson. Bureau of Mines, Report of Investigations, R. I. 3709. Mimeographed.

Increased Pig-Iron Output through Improved Coke, by L. D. Schmidt and others. Bureau of Mines, Report of Investigations, R. I. 3711. Mimeographed.

Selection, Use, and Maintenance of Respiratory Protective Devices, by H. H. Schrenk and S. J. Pearce. Bureau of Mines, Information Circular I. C. 7236. Mimeographed.

Permissible Mine Equipment Approved During 1942, by E. J. Gleim. Bureau of Mines, Information Circular I. C. 7240. Mimeographed.

Annual Report of Research and Technologic Work on Coal, Fiscal Year 1942, by A. C. Fieldner and W. E. Rice. Bureau of Mines, Information Circular I. C. 7241. Mimeographed.

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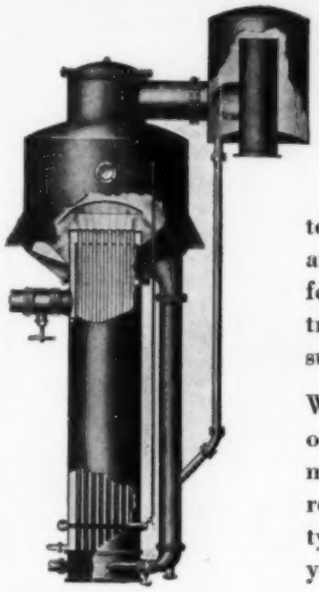

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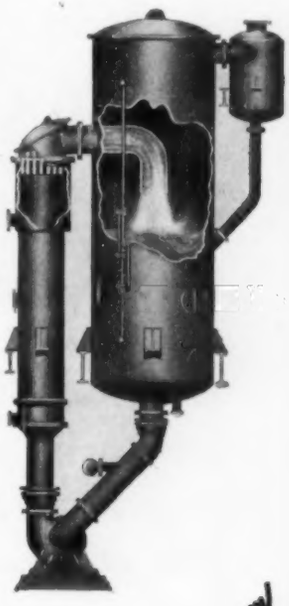

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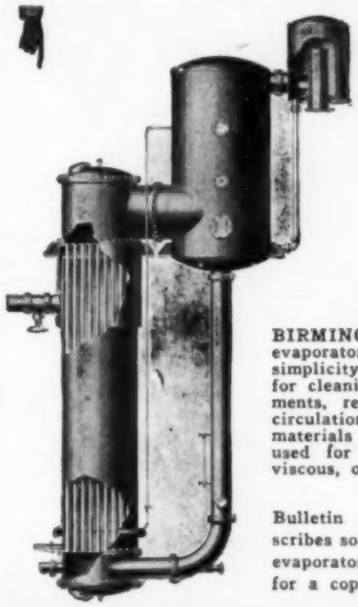

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Petroleum, Coal, and other Materials, by W. C. Holliman. Bureau of Mines, Information Circular I. C. 7242. Mimeographed.

Fiber-Flax Machinery and Processing Operations in Oregon, by W. M. Hurst. Department of Agriculture, Circular No. 667. Price 10 cents.

Effect of Climate on the Yield and Oil Content of Flaxseed and on the Iodine Number of Linseed Oil, by A. C. Dillman. Department of Agriculture, Technical Bulletin No. 844. Price 15 cents.

Instructions for the Operation and Maintenance of Refrigerating Plants. Navy Department, Chapter 59 of the Bureau of Ships Manual. Price 30 cents.

Directory of Commodities and Services. Office of Price Administration, unnumbered document. An index to price and rationing regulations and jurisdiction of operating units. Price 30 cents.

Legal Aspects of Civilian Protection. Prepared by the American Bar Association. Office of Civilian Defense, OCD 2701. Civilian Defense Manual. Price 35 cents.

The Action of Some Aqueous Solutions on Clays of the Montmorillonite Group. By P. G. Nutting. U. S. Geological Survey, Professional Paper 197-F. Price 10 cents.

A Summary of Census Data on Water Treatment Plants in the United States. By S. R. Weibel. Public Health Service. Reprint No. 2416 from the Public Health Reports. Price 5 cents.

Douglas Fir Plywood. Bureau of Standards, Commercial Standard CS45-42. Price 10 cents.

Report of the Chief of the Bureau of Agricultural Chemistry and Engineering, 1942. Bureau of Agricultural Chemistry and Engineering, unnumbered document. Price 10 cents.

Transportation by Water of Explosives, Inflammables and Chemical Materials. War Department, Army Regulations No. 55-470. Price 5 cents.

Directory of Byproduct Coke Plants in the United States, December 31, 1942. Bureau of Mines, unnumbered document. Mimeographed.

Sales and Uses of Lime in 1942. Bureau of Mines, Mineral Market Report, MMS. No. 1053. Mimeographed.

Scrap Dealers Supplied Almost a Million Tons of Nonferrous Metals in 1942. Bureau of Mines, Mineral Market Report, MMS. No. 1054. Mimeographed.

Concentration of Manganese-Bearing Ore from the Barytes Mining Co., Cartersville District, Cartersville, Ga. By W. A. Calhoun and others. Bureau of Mines, Report of Investigations, R. I. 3684. Mimeographed.

The Prevention of Butadiene-Air Explosions by the Addition of Nitrogen and Carbon Dioxide. By G. W. Jones and R. E. Kennedy. Bureau of Mines, Report of Investigations, R. I. 3691. Mimeographed.

Danger from Carbon Monoxide in the Home. By H. H. Schrenk. Bureau of Mines, Information Circular, I. C. 7238. Mimeographed.

Census of Agriculture. 16th Census of United States, 1940. Bureau of the Census. Agriculture, cows milked, and dairy products, number of cows milked, milk produced, disposition of dairy products, and number of cows milked, by counties; with related data for other classes of livestock and livestock products, for the States and for the United States. 1942. Price $1.25. Clothbound.

Census of Drainage. 16th Census of United States, 1940. Bureau of the Census. Drainage of agricultural lands, land in drainage enterprises, capital invested, and drainage works, statistics for counties, with State and United States summaries and a synopsis of drainage laws. Price $2.00. Clothbound.

Population. First Series. Number of Inhabitants. United States Summary. 16th Census of the United States, 1940. Bureau of the Census. Total population for states and counties for urban and rural areas for incorporated places and for metropolitan districts. Price 20 cents.

Population. Second Series. Characteristics of the Population. United States Summary. 16th Census of the United States, 1940. Bureau of the Census. Sex, age, race, nativity, citizenship, country of birth of foreign-born white, school attendance, education, employment status, class of worker, major occupation group, and industry group. Price 40 cents.

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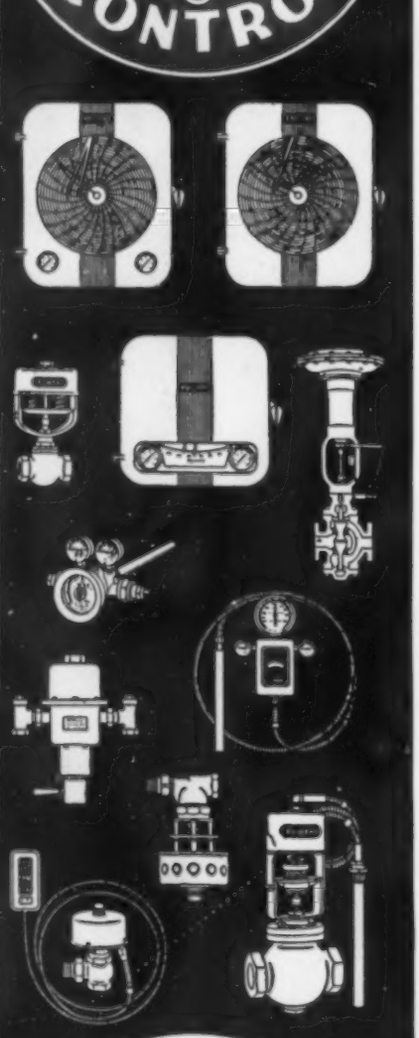

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Fluorescent Fixtures. Mitchell Mfg. Co., 2525 No. Clybourn Ave., Chicago, Ill.—Catalog 400—8-page form which announces this concern's improved all-purpose "Mitchelite" line of fluorescent fixtures for war industries. Each fixture is illustrated and discussed briefly. Includes a price list.

Electric Gages. General Electric Co., Schenectady, N. Y.—Form GEA-3991—8-page folder which illustrates and discusses the line of 21 electric gages put out by this concern. Contains a chart showing schematic representation of electric gage circuit applications. Describes thickness, magnetic, electrolimit, pressure, strain and eccentricity gages.

Boiler Water Treatment. Elgin Softener Corp., Elgin, Ill.—Bulletin 504—16-page catalog dealing with this concern's deconcentrator system for treating and purifying boiler water. Contains extensive photographic reproductions and schematic drawings, together with tables of data.

Optical Comparator. Fish-Schurman Corp., 230 East 45th St., New York, N. Y.—Bulletin OC292—4-page bulletin on this concern's new optical contour comparator for visual comparison and measurement of small parts. Discusses outstanding features of the instrument, its speed and accuracy, specifications and applications.

Bar Windows. E. K. Geyser & Co., 200 Cedarhurst St., Pittsburgh, Pa.—File 16E—16-page booklet discussing and illustrating this concern's line of aluminum and wood bar windows. Contains extensive tables of engineering data and cross sectional drawings of ventilator types, detailed lay-outs and standard sizes. Well illustrated.

Corrosion Control. D. W. Haering & Co., Inc., 205 W. Wacker Drive, Chicago, Ill.—28-page new edition of this concern's catalog on "Organic Methods of Scale and Corrosion Control." Includes data on this concern's line of glucosates for scale and corrosion control. Well illustrated with photographic reproduction, charts and diagrammatic drawings.

Plastics Molding. Bakelite Corp., 30 E. 42nd St., New York, N. Y.—Form F5415—16-page catalog giving technical data on the technique of molding this concern's line of low-loss phenolic materials. Gives principles in mold design for parts produced from these materials, mold charge, operations, and steps to correct unsatisfactory moldings. Contains useful information on the subject.

Fire Extinguishers. American-La-France-Foamite Corp., Elmira, N. Y.—Two 1-page charts explaining the use of all types of fire extinguishers. Covers characteristics, capacity, range of stream, etc., of various types of extinguishers. Contains very useful information in simple form.

Heat Treatment. Lindberg Engineering Co., 2450 W. Hubbard St., Chicago, Ill.—Bulletin 140—8-page booklet dealing with this concern's line of furnaces for the heat treatment of aluminum, magnesium and their alloys. Shows the types available, explains the Lindberg zone control method of heating large loads, illustrates construction features, and lists sizes available in both vertical and box type furnaces.

Lubrication. Fiske Bros. Refining Co., 129 Lockwood St., Newark, N. J.—15-page catalog giving data relating to proper lubrication of food products

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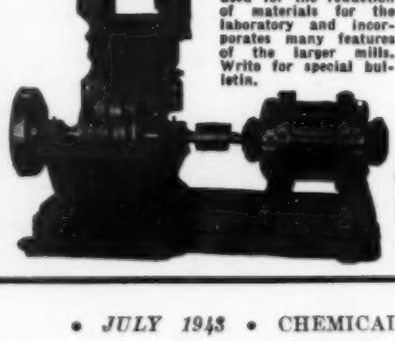

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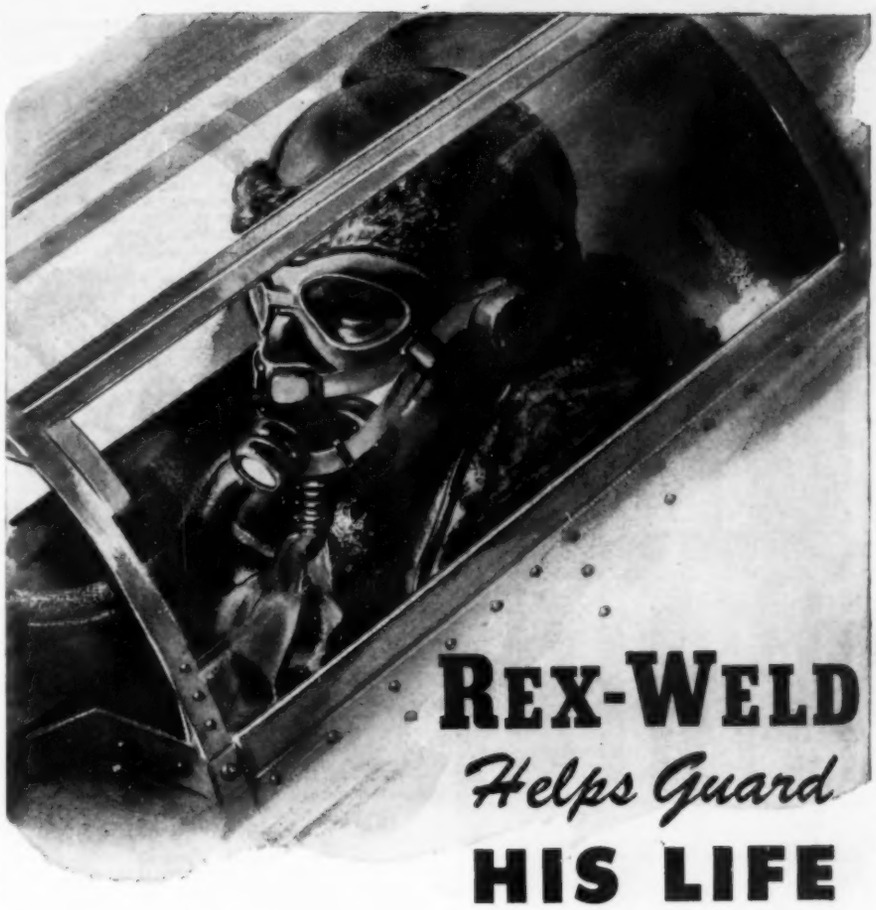

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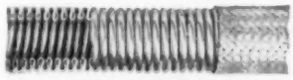

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Lead Plating. The Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio—8-page booklet dealing with lead plating with this concern's fluoborate lead solution concentrate. Gives suggested uses for lead plating, method of solution preparation, bath concentration and rate of deposition, thickness of deposit, solution control, and precautions. Contains tables of operating data.

Transmission. Reeves Pulley Co., Columbus, Ind.—Catalog TR 432—14-page catalog on this concern's line of variable speed transmission with built-in reducer. Contains extensive engineering data and rating tables, selection charts and numerous dimension diagrams. Illustrated with photographic reproductions.

Heat Exchanger Tubing. Formed Steel Tube Institute, 1621 Euclid Ave., Cleveland, Ohio—20-page booklet entitled "Manual of Welded Steel Tubing for Heat Exchanger and Condenser Use." Intended as a buyers' guide and reference data book for use of purchasing agents, design engineers and others concerned with procurement or use of welded carbon and alloy steel tubing for heat exchangers, condensers and other types of heat transfer equipment. Contains tables of engineering data and diagrammatic sketches. Illustrated with photographic reproductions.

Welding Electrodes. Air Reduction, 60 E. 42nd St., New York, N. Y.—four-page form serving as a comparative index of welding electrodes. Details the principal A. W. S., and A. S. T. M. electrode classifications, and indicates which electrodes produced by 20 leading manufacturers meet different requirements.

Analytical Instruments. Leeds & Northrup Co., 4907 Stenton Ave., Philadelphia, Pa.—Bulletin E-941—16-page booklet giving the latest improvement in this concern's "Electro-Chemograph" dropping-mercury-electrode recording equipment for quantatative and qualitative analysis by determination of current-potential relations. Gives principle of the instrument, method of operation, limitations, applications, and accessory apparatus. Contains photographic reproductions, cross-sectional drawings, charts, price list, and tables of data.

Food Processing Equipment. The Pfaudler Co., Rochester, N. Y.—Bulletin 819—20-page catalog describing and illustrating this concern's line of processing equipment for the food industries. Includes data on mixers, kettles, grinders, etc. Each unit is described, illustrated by photographic reproduction and cross-sectional drawings. Contains tables of capacities and dimensions.

Autoclave. The Pfaudler Co., Rochester, N. Y.—Bulletin 820—2-page form introducing this concern's new 100-gal. glass lined steel laboratory autoclave built for experimental work involving internal pressures up to and including 500 lb. per sq. in. Includes sectional diagrams and dimensional data.

Hardness Measurement. Eberbach & Son Co., Ann Arbor, Mich.—10-page catalog dealing with this concern's new microhardness tester for metallurgical laboratories to measure hardness of single grains in alloys, of plating, of nitrided and cyanided layers, and of pieces too small for other hardness testers. Includes price list and specification data, directions for using, hardness conversion tables, etc. Well illustrated with photomicrographs.

Explosive Rivets. E. I. du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.—5-page folder giving details on selection, handling, and proper use of explosive rivets for high-speed blind riveting. Contains tables of selection data and tip dimensions.

Rubber Substitutes. Dispersions Process, Inc., 1230 Sixth Ave., New York, N. Y.—2-page form describing briefly this concern's line of Dispersite mixers and blending tanks for use with water dispersions of crude and reclaimed rubbers and other materials.

Laboratory Equipment. Eimer & Amend, 635 Greenwich St., New York, N. Y.—14-page booklet describing the facilities, production methods, handling procedures and services of this dealer in laboratory equipment.

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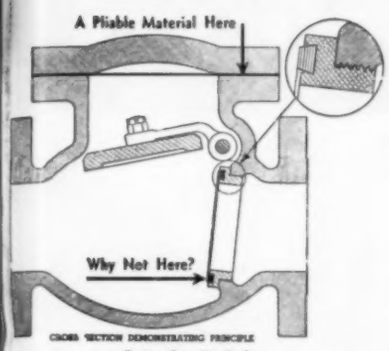

Pat. Applied For

SYNTHETIC RUBBER SEAL FULL OPENING, SWING CHECK

VALVE

Equipped with Wheatley Synthetic Seal —a synthetic rubber ring dovetailed and fitted into a removable bronze seat also dovetailed to accept this rubber ring. When the bronze clapper falls against this rubber, a perfect seal is formed regardless of what irregularities have deposited on the seat or in the fluid, such as sand, scale and cuttings which under pressure ordinarily would completely cut out a hard-surfaced seat.

Preferred by the United States Engineers on projects handling high octane gasoline.

Sizes 2" to 24"
Pressures
125 lbs. to 2000 lbs.
Series 15-30-40-60
and Ludlow
FBE - SBE - SOE & FOE
Steel-Iron-Bronze

- The rubber ring conforms to all deposits and obstacles and makes it possible for this valve to seal under the worst conditions.
- Seals regardless of viscosity.
- Operates equally well on kerosene or crude.
- Absolutely silent in operation. Ideal for refineries and pumping stations where the slapping of metal check valve clappers is annoying.
- No lapping or grinding of seats necessary.
- Renewable bronze seat ring, into which the rubber ring is inserted, can be replaced by the standard metal to metal seat, if desired.

Write for Bulletin No. CM-1

WHEATLEY
PUMP and VALVE MFR.
Hale Station, Sand Springs Road
TULSA, OKLAHOMA

Centrifuges. Centrifuge Mechanical Equipment Inc., 19 Rector St., New York, N. Y.—four-page form illustrating and discussing briefly this concern's line of continuous centrifuges of the solid bowl and screen types for various extraction processes. Includes a detailed drawing of the continuous screen type.

Shift Schedules. George F. May Co., May Bldg., 2600 North Shore Ave., Chicago, Ill.—a cardboard "Shift-O-Graph" design to facilitate working out shift schedules by various plans. Describes the plans and gives instructions for operating the instrument.

Metallic Tubing. Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.—Catalog 113.—36-page catalog dealing with this concern's all-metal flexible hose for various industrial purposes. Describes manufacturing methods and materials, typical applications, connection problems, etc. Contains extensive application data and diagrammatic pictures. Well illustrated. Includes complete pressure charts, charts showing radius of bends, and other essential data.

Oil Heater. The Griscom-Russell Co., 285 Madison Ave., New York, N. Y.—Bulletin 1641—Ten-page booklet on the "G-Fin" storage tank oil heater put out by this concern. Explains the unique construction of the G-Fin elements, graphically shows distinctive advantages of the heater design, and explains different arrangements in which the heater is furnished. Includes complete tables of dimensions and ratings. Extensively illustrated by photographic reproductions and diagrammatic pictures.

Pipe Maintenance. Reps Tool Co., Inc., 82 Wall St., New York, N. Y.—Four-page form explaining briefly and illustrating this concern's heavy-duty extractors for removing stub ends of pipe, nipples, tubes, bolts or screws. Explains principles of operation and gives illustrations of applications.

Lignum-Vitae Wood. Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.—Twelve-page booklet dealing with the wartime uses of lignum-vitae, a very hard resinous wood from the tropics. Includes data on working pressure, self-lubricating properties, acid resistance and other properties. Includes a brief description of 25 case applications of this material in chemical, ordnance, canning, synthetic rubber and other plants for bearings, bushing, rollers, etc. Contains an extensive listing of possible applications.

Valve Seats. The Cooper-Bessemer Corp., Mount Vernon, Ohio—Small folder which describes briefly and illustrates this concern's line of valve seat grinding equipment for maintenance of Cooper-Bessemer engines. Includes price lists.

Butterfly Valves. R. S. Products Corp., Wayne Junction, Philadelphia, Pa.—Bulletin 16-B—Four-page illustrated booklet which contains complete dimension tables for this concern's line of butterfly valves from 15 to 125 lb. per sq. in. Illustrated by diagrammatic sketches.

Plywood. The Resinous Products Chemical Co., Washington Square, Philadelphia, Pa.—Bulletin 4—14-page bulletin giving technical data on the flexible bag molding of curved plywood. Deals with the subjects of adhesive requirement, behavior of various Amberlite resins, assembly time, pressure and temperature, method of applying flexible pressure to molded plywood, plywood construction, etc. Contains extensive data in chart and graph forms. Illustrated by diagrammatic sketches. Contains a bibliography.

Vibrating Equipment. The Jeffey Mfg. Co., Columbus, Ohio—Catalog 750—176-page catalog dealing with this concern's complete line of vibrating equipment, including feeders, waytrols, bin valves, conveyors, driers, coolers, packers, screens, and electrical equipment. Each unit is illustrated and described. Contains extensive photographic illustrations and detailed diagrammatic drawings, as well as useful tables and charts of engineering data.

Equipment. Vulcan Iron Works, Wilkes-Barre, Pa.—Bulletin A375—12-page catalog on the equipment put out by this concern, including continuous rotary kilns, coolers and driers, roasters, calciners, pulverizers and grinding mills, gears, etc. Each unit is illustrated and described briefly.

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INCREASE OUTPUT
by automatic timing of
MOTORS Control starting, stopping, running and sequence.
ALARMS Bells, lights or horns signal critical periods.
VALVES Actuate motorized or solenoid valves exactly on time.

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"Vernier-Set" Timer, extremely accurate, easily installed, requires no lubrication. Telechron motor-operated, SPDT contact action, resetting or non-resetting upon power interruption. Dials from 0-15 sec. to 0-60 hrs., timed period set easily with knob. Operates from 110 or 220 V., AC; large silver contacts carry 25 amps. at 110 V., AC or 1 amp. at 110 V., DC. Thousands now serving industry dependably.

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Send me free copy of Catalog B10 giving detail data on your "Vernier-Set" Timers, and let me have more information concerning their application to the following items which I've checked (√).

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☐ ALARMS & SIGNALS
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☐ .....

Name.....
Title.....
Firm.....
Address.....

atc *Industrial Controls*
AUTOMATIC TEMPERATURE CONTROL COMPANY, INC.
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Metal at work

EVERDUR* STILL KETTLE

With a diameter of 8 feet and a length of 13 feet, this still kettle is fabricated of Everdur. The working pressure developed is 50 psi. Coil working pressure is 125 psi. Manufactured by Leader Iron Works.

EVERDUR CALANDRIA OR REBOILER

This big reboiler is 56" in diameter with an overall height of 18', 4". Fabricated of rust-proof, corrosion-resistant Everdur, it is fitted with 522 copper tubes, expanded in 1½" rolled Everdur tube sheets.

The reboiler, of the natural circulation type, is used at the base of a fractionating column in a huge chemical plant. Shell pressure is 40 psi. Designed and fabricated by The Vulcan Copper & Supply Co.

*Reg. U. S. Pat. Off.

ANACONDA from mine to consumer

Anaconda Copper & Copper Alloys

ECONOMICS AND MARKETS

CHEMICAL CONSUMPTION IN INDUSTRIAL LINES HOLDS ABOVE LAST YEAR'S LEVEL

PRODUCTION of chemicals as indicated by the indexes of the Federal Reserve Board, was about 32 percent higher in the first half of this year than in the comparable period of 1942. While there admittedly has been some rather large accumulations of certain chemicals, the bulk of production has either passed into consuming channels or has been exported. The fact that exports of chemicals have run to large figures makes it clear that total consumption has fallen considerably short of actual outputs. Stockpiles and export shipments, in part explain the discrepancy between the *Chem. & Met.* indexes for consumption of chemicals and the official indexes for their production. For the first six months of this year, the consumption indexes point to an increase of about 3 percent in the use of chemicals in regular industrial lines as compared with the first half of last year. With due allowance for stockpiles and exports, the difference shown by the production and consumption indexes might be assumed as representing the totals going into direct war industries.

The *Chem. & Met.* index for consumption for May rests at 179.83 with 176.16 as the revised figure for April. These compare with 171.12 and 171.38 for the corresponding months of last year. The slightly higher rate maintained this year can be traced directly to war influences as war demands force larger outputs of such products as steel, plastics, and fertilizer. The importance laid upon larger production of crops has tended to keep superphosphate production along a fairly even keel with the customary seasonal influences not in evidence. The program for the 1943-44 season calls for a minimum of 6,600,000 tons of ordinary superphosphate or 13 percent more than has been produced in any season to date. To turn out this total, assuming that regular deliveries of phosphate rock and sulphuric acid are made, production will have to be scheduled on a fairly even monthly basis.

There was a notable pickup in activities at petroleum refineries in the latter part of June but reports of a different character were heard regarding operations at steel plants. War demands call for record amounts of steel in the third quarter of this year and it is known that producers are planning to get the extra output. Demands for glass containers has been so heavy that some controls have been placed over distribution. The output of containers in May made a new monthly record but flat glass production was not in keeping.

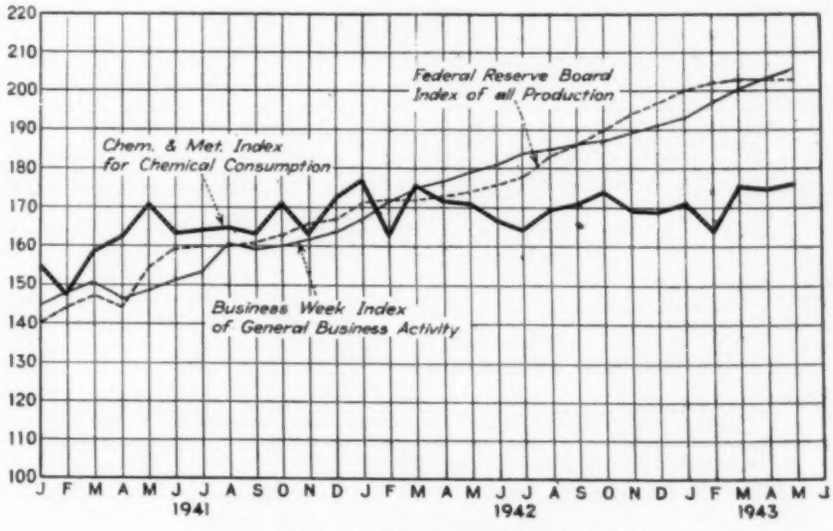
Production of rayon continues at a record pace and the output this year promises to top all previous totals. Large amounts taken in the war program have caused fears of a shortage for civilian use but it is said that high-tenacity rayon can be supplied to meet all military requirements without seriously cutting into supplies for other purposes. In addition to the 100,000,000 pounds already being produced, an increase of 68,000,000 pounds for tire cords has been authorized to carry out the program of the Rubber Director. An additional 32,000,000 pounds is also under consideration and will probably be authorized, making a total production of approximately 200,000,000 pounds.

The 68,000,000 pound expansion can be taken care of with present facilities but anything beyond that will require new facilities from the ground up. Increased requirements of certain chemicals will result. The supply of caustic soda presents a problem of quality rather than quantity and sulphuric acid a problem of location because of its short economical shipping radius. Carbon bisulphide production may require new facilities to relieve severe distribution difficulties that are expected. All but a very small portion of the program will be produced from linters which are in excellent supply.

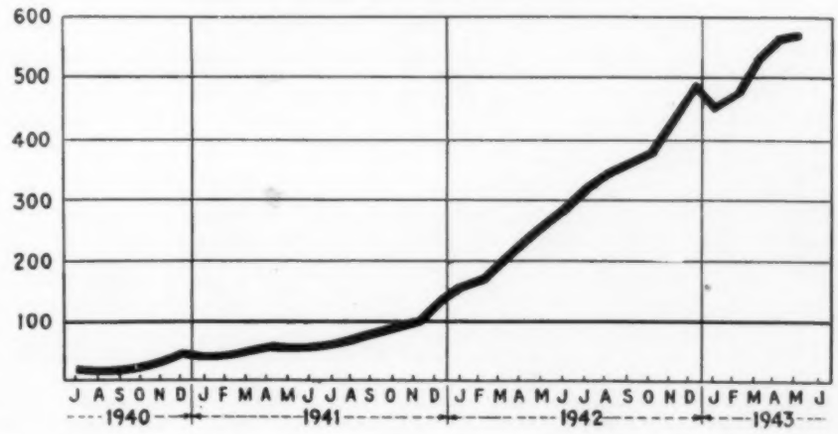
While the government index for munitions production includes such components as ships, planes, and tanks as well as munitions proper, all have some effect upon the distribution of chemicals and the accompanying graph will be of interest in accounting for the sharp rise the Federal Reserve Boards index for production of chemicals.

Chem. & Met. Index for Industrial Consumption of Chemicals

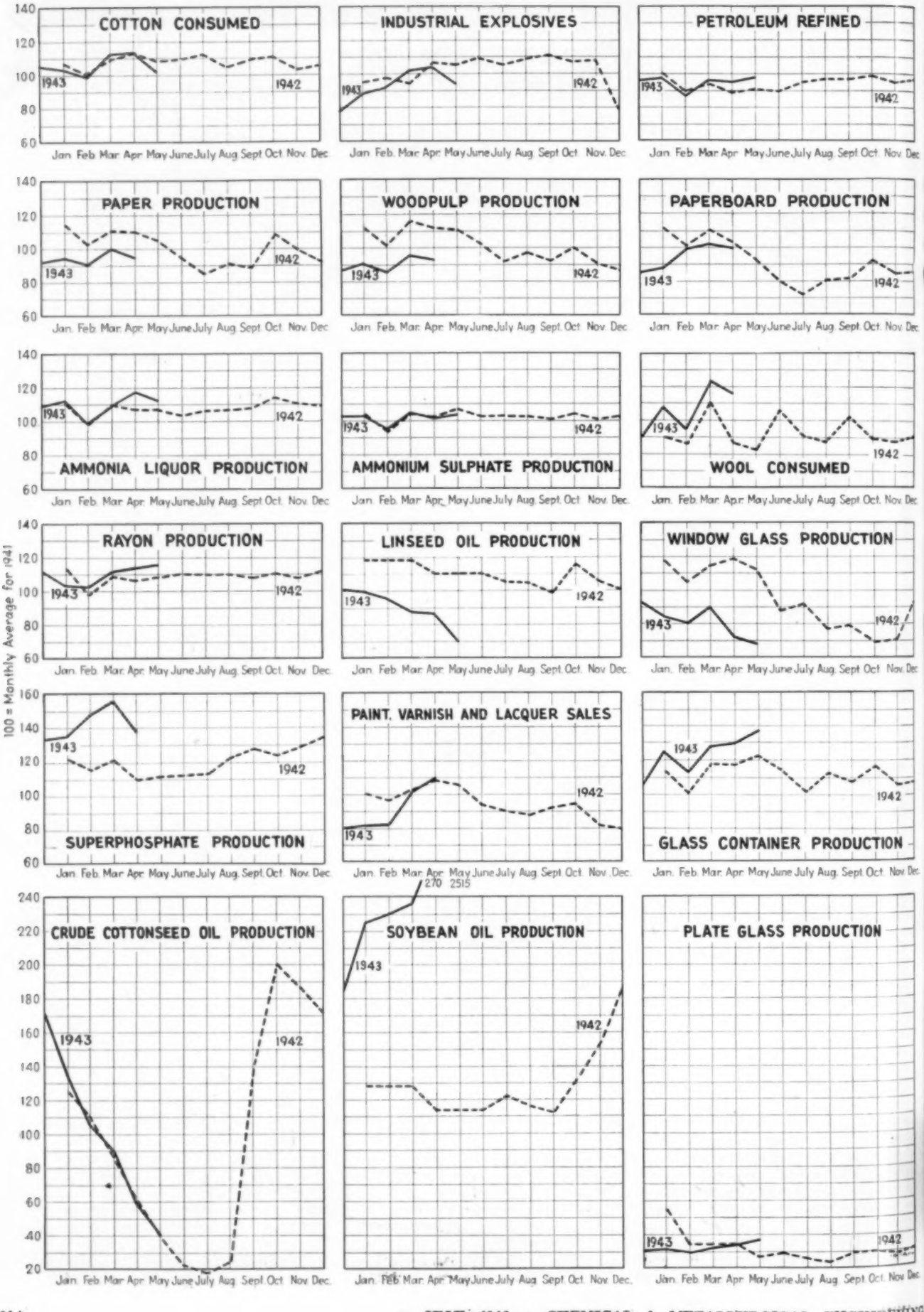
	April revised	May
Fertilizers	38.90	40.06
Pulp and paper	19.40	19.98
Petroleum refining	14.56	15.07
Glass	18.50	19.30
Paint and varnish	16.53	16.50
Iron and steel	13.42	13.84
Rayon	15.63	15.92
Textiles	11.82	11.72
Coal products	9.52	9.61
Leather	4.65	4.65
Industrial explosives	5.63	5.28
Rubber	3.00	3.00
Plastics	4.60	4.80
	176.16	179.83



Munitions Production Index November 1941 = 100



Production and Consumption Trends



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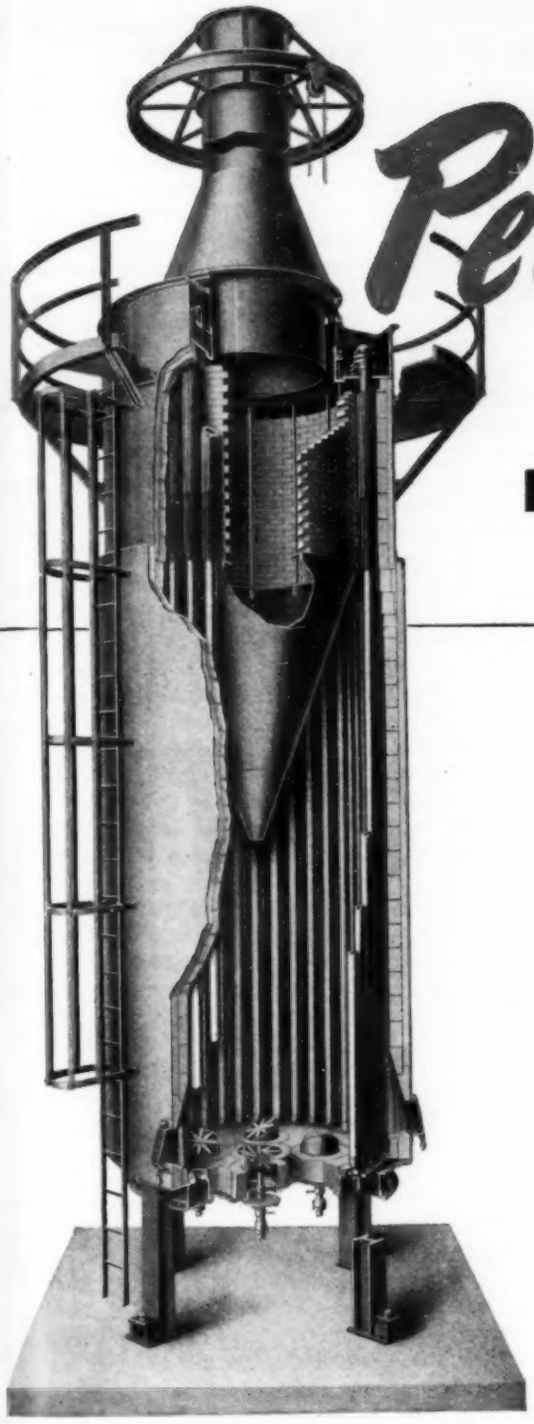
ISO-FLOW* FURNACE

(RADIANT-CONVECTION TYPE)



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save 30 to 50% in Critical Materials

are Prefabricated and shipped in units ready for quick erection

may be moved from one site to another with minimum expense.

VERTICAL TUBES and INTEGRAL STACK require minimum ground space.

All TUBES can be cleaned or removed from the top platform *without breaking any rolled joints.*

RERADIATING CONE effects even heat distribution throughout combustion chamber.

FIN TUBE CONVECTION SECTION gives high efficiency with short path of fluid travel and low pressure drop.

BURNERS designed to permit change in direction of firing while in operation.

SYMMETRICALLY PLACED VERTICAL TUBES protect *entire refractory lining* — maintenance negligible.

In design and operation ISO-FLOW* Furnaces meet every requirement and application for any service, capacity or duty.

*Reg. U.S. Pat. Off.
Patents issued and pending.

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Representatives: Bethlehem Supply Co., *Tulsa, Houston, Los Angeles* Faville-Levally Corp., *Chicago.*

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TWO-WAY CURRENT FAILURE VALVES

General Controls G-1 Series Valves are two-way current failure *Hydramotor Valves designed for operating pressures up to 300 lbs. G-1 Valves are suitable for gas, oil, water, air and steam. Approximate opening time 8-10 seconds; closing —2 seconds. Operator dimension only 4¼", diameter 6" high, weight approximately 7½ lbs. Write for Catalog 52.

*Trademark registered United States Pat. Office.

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ALCOHOL PRODUCTION AND DISTRIBUTION PLACED UNDER CONTROL OF GOVERNMENT AGENCIES

THE MOST important market development of the last month was found in an announcement that ethyl alcohol made from grain had been placed under government control. This procedure was unusual inasmuch as the arrangement provides control over production and distribution and at the same time fixes prices for producers and consumers. In substance, the plan directs that all ethyl alcohol produced from grain is to be purchased by the Defense Supplies Corp. Under a subsidy program, the price to be paid producers will be based upon actual producing costs plus specified margins of profit. The price to industrial users will be unchanged at the current price of 48c a gal. in tanks. Sales to government plants will be based on production costs. The Office of Price Administration collaborated in the plan and worked out a price formula. Profits are fixed at 4c a gal. on sales up to 750,000 gal. within any quarter, 3c a gal. on sales over that figure and up to 1,500,000 gal., and 2c a gal. on sales of more than 1,500,000 gal. The price paid to producers will vary as they will be based on individual plant operations where differences in cost of raw materials, labor, and other overhead charges will be important. In addition to these costs an allowance of 3c a gal. will be granted to cover selling and general administrative expenses.

Because of the difficulty in getting some raw materials and the probability of higher prices, the OPA has issued a regulation that after July 1, deliveries of butyl alcohol made from grain may be made on an adjustable price basis. Production costs have varied as molasses, corn, and wheat have been used as raw materials. The new ruling places trading on an indeterminate basis and some agitation has arisen for a sliding scale of prices to conform with the variations in production cost.

Heavy demands for fluorspar have kept supplies at a low level and as a spur to production, a general advance of about $5 a ton has been authorized. Acid grade is now quoted at $37 a ton with adjustment for freight differentials. Another price advance made to encourage larger production is noted in the case of casein. The increase amounts to 3c a lb. The ceiling prices for wet and dry curd casein range from 18c to 22½c a lb. and for industrial processed casein of different types range from 24c to 25½c a lb. Prices are fob shipping point with provision for quantity discounts and for the addition of lowest freight charges when delivered prices are quoted.

The general movement of chemicals from producing plants has been heavy. With the bulk of production moving against contract orders, the supply for the spot market is restricted yet a fairly active demand has been in evidence with a good part of the inquiry for foreign account. The export movement likewise has been larger because of substantial amounts going out on lend-lease.

The uncertainty regarding supplies of cornstarch has not lessed and some producing plants have been forced to close pending arrival of the raw material. Some corn has been made available but so far there is no indication of a continuous supply in the amount required. From present indications, it may be necessary to make upward readjustments in the price for corn which in turn would affect the cost of producing the starch. In the meantime consumers are not sure of getting supplies.

Based on the acreage sown to flax, the coming season will see the largest production of linseed oil ever achieved in this country. As Canada also has a large potential crop the Hemisphere possibility is far ahead of normal. However, this has no bearing on the present market where the demand has been sufficient to hold stocks at low levels especially since some crushers were not operating because of the seed situation. Large amounts of linseed oil are going out of the country on lend-lease, mainly in the form of an edible product. The food administration last month directed crushers to reserve 45 percent of their crude oil production. It is held that these reservations will prevent disturbances in the market which might follow if government agencies entered the market at intervals for round lots.

The seriousness of the oil situation is further seen in a regulation issued early this month whereby the War

CHEM. & MET. Weighted Index of CHEMICAL PRICES

Base = 100 for 1937

This month	109.03
Last month	109.01
July, 1942	109.33
July, 1941	101.17

Ceiling prices for casein were raised and those for ethyleneglycol lowered. Deliveries of butyl alcohol are being made on an adjustable price basis. A strong market ruled for rosin and turpentine. Ethyl alcohol market under subsidy.

Foods Administration ordered producers of fish oils to set aside for government purchase, every sixth car of new production. The regulation also ordered a cut of 40 percent in consumption of fish oils in specified industries. The industries affected include shortening, water soluble soap, paint, varnish, lacquer, other protective coatings, linoleum, felt base floor coverings, oilcloth, and printing inks. The restrictions do not apply to fish oil used in vitamin feeding oil for poultry, in medicinals and pharmaceuticals, lubricating oils and greases, metal working compounds other than core oils, leather processing, terne plating and galvanizing, alkyd resins, core oil for aluminum and magnesium castings.

Incidentally the position of corn and other grains which has been so disturbing in the market for many finished products, also has a bearing on the market for ethyl alcohol. It is true that the immediate situation is not critical because of the earlier efforts made to accumulate surpluses of alcohol. Future production, however, has been a matter of concern and the industry has discussed ways and means for holding production up to the necessary standards. New sources of supply have been given consideration. One of these is connected with new production started in Canada where waste sulphite liquor is the raw material.

In order to add to the supply of glycerine several million pounds of crude soybean oil, use of which has been restricted to edible products for several months, will go into the production of glycerine during July and August, the War Food Administration reports. The WFA is making the oil available to fat splitters and soap manufacturers to relieve a short supply of tallow and grease. The oil may be obtained during July and August in tank car quantities, but must be used in accordance with the provisions of Food Distribution Order No. 33, which establishes the standards of glycerine recovery.

CHEM. & MET.

Weighted Index of Prices for

OILS & FATS

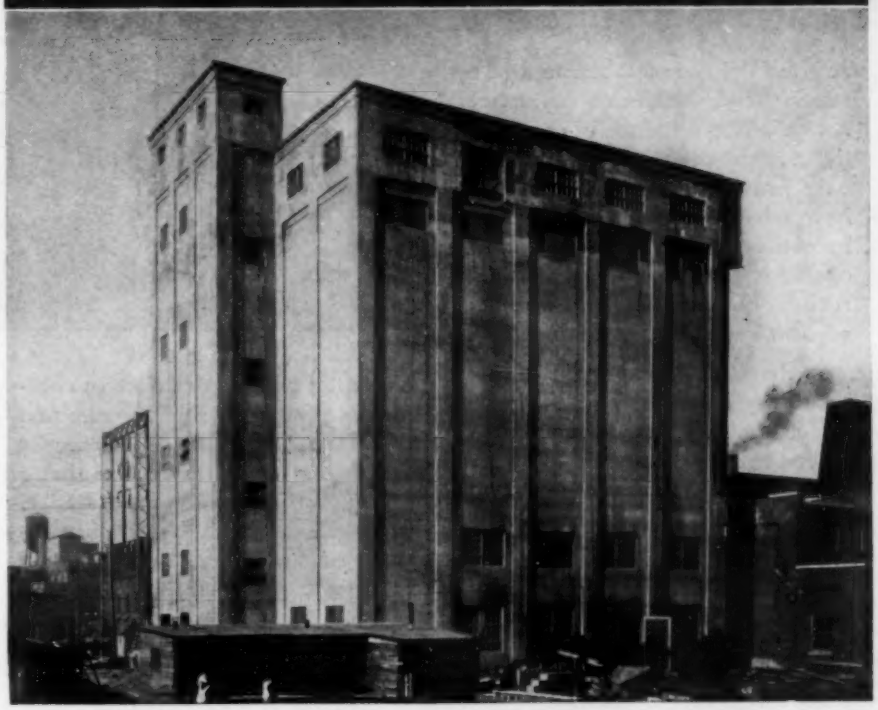
Base = 100 for 1937

This month	145.55
Last month	145.55
July, 1942	143.22
July, 1941	72.37

Prices in general were firm at limitation levels. Some crushers were not quoting on linseed oil and the ceilings were little better than nominal. Corn oil production affected by scarcity of raw material with some plants not operating.

CONCRETE BINS AND TANKS

A SPECIALIZED DIVISION OF THE ENGINEERING AND CONSTRUCTION FIELD



Fifty-five hundred ton blending bins recently completed for The Carborundum Company, Niagara Falls, N. Y., for the storage and handling of seven different materials . . . designed and built by The Nicholson Company, New York.

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NICHOLSON BINS & TANKS, as designed and built today, have back of them 30 years of experience in specialized storage construction and handling equipment for all granular and liquid materials.

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GOOD?

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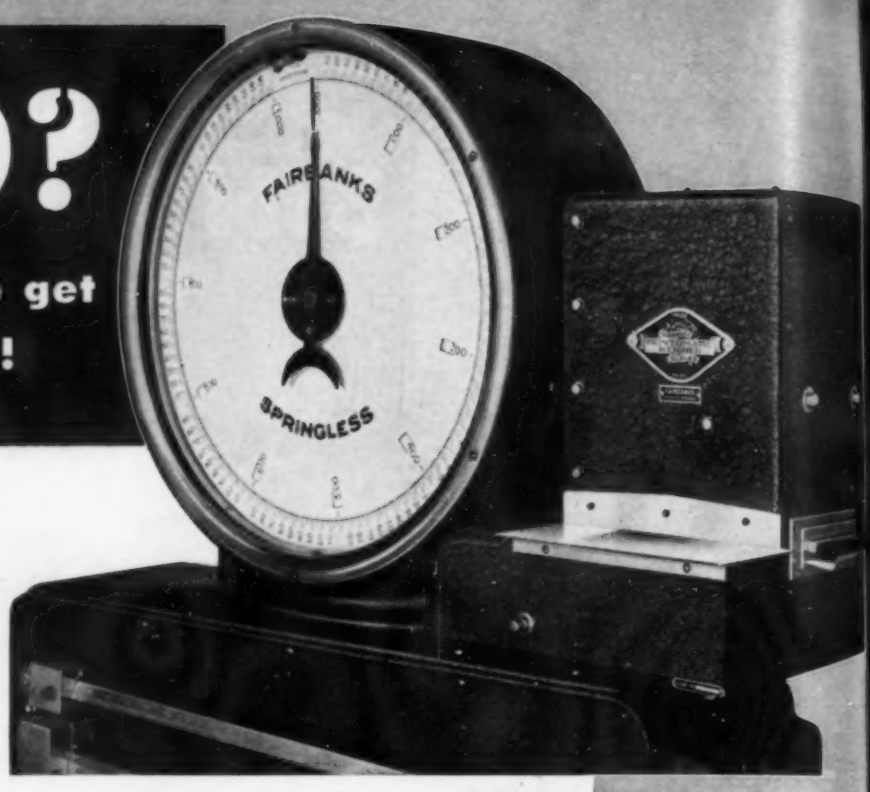

In good light or bad . . . operated by experienced weighmen or novices . . . weighing all kinds of commodities . . . Fairbanks Printomatic Scales have proved to the world that they have what it takes! They eliminate human errors, speed up weighing operations, and provide a PRINTED record showing what was weighed, who weighed it, and when.

Fairbanks Scales have proved their reliability through their 113 years of service. Each part, carefully designed for its specific function and built with precision, guarantees your incoming, outgoing, and processing weight operations.

The Printomatic records the correct weight automatically, prints it on a roll tape, weigh ticket, or combination of both, or on gummed tickets. Adaptation of Fairbanks Printomatic Scales to weighing problems, simple or complicated, is practically unlimited. Why not investigate what these scales can do for you? Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

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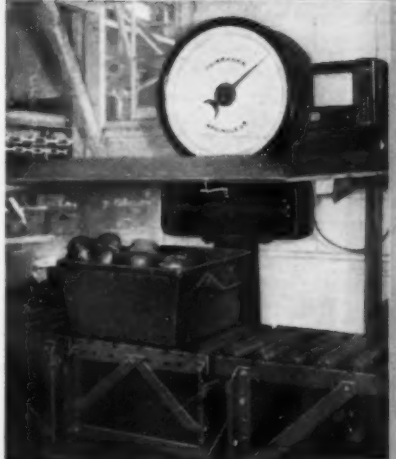
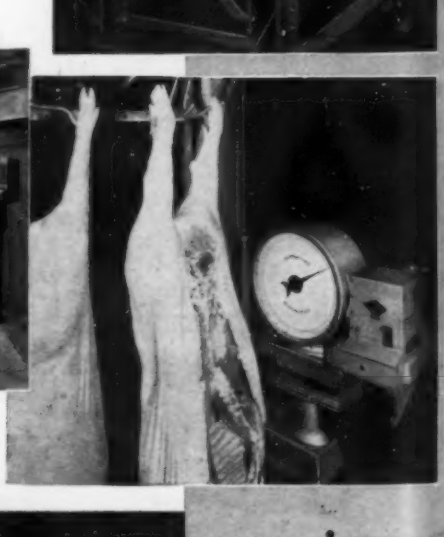


Fairbanks Printomatic Conveyor Scale → keeps printed record of piecework in foundry.

← Fairbanks Printomatics recording meat shipments to retailers. Each of 221 different kinds of meat is given a designating number.

Fairbanks Coal Mine Car Scale with Printomatic weighs mine cars in motion, protecting employer and miner.



Fairbanks Portable Dial → Scale with Printomatic weighing and printing records of meat to retailers.

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SCALES

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AIR CONDITIONERS
RAILROAD EQUIPMENT

FAIRBANKS SCALES

Scales

CURRENT PRICES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.085–$0.109	$0.085–$0.109	$0.168–$0.173
Acid, acetic, 28%, bbl., cwt.	3.38 - 3.63	3.38 - 3.63	3.38 - 3.63
Glacial 99.5%, drums	9.15 - 9.40	9.15 - 9.40	9.15 - 9.40
U.S. P. X 1, 99.5%, dr	10.95 -11.20	10.95 -11.20	10.95 -11.20
Boric, bbl., ton	109.00–113.00	109.00–113.00	109.00–113.00
Citric, kegs, lb.	.20 - .23	.20 - .23	.20 - .23
Formic, cbys., lb.	.10½- .11	.10½- .11	.10½- .11
Gallic, tech., bbl., lb.	1.10 - 1.15	1.10 - 1.15	1.10 - 1.15
Hydrofluoric 30% drums, lb.	.08 - .08½	.08 - .08½	.08 - .08½
Lactic, 44%, tech., light, bbl., lb.	.073- .075	.073- .075	.073- .075
Muriatic 18°, tanks, cwt.	1.05 -.....	1.05 -.....	1.05 -.....
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -20.00	18.50 -20.00
Oxalic, crystals, bbl., lb.	.11½- .13	.11½- .13	.11½- .13
Phosphoric, tech., c'bys., lb.	.07½- .08½	.07½- .08½	.07½- .08½
Sulphuric, 60°, tanks, ton	13.00 -.....	13.00 -.....	13.00 -.....
Sulphuric, 66°, tanks, ton	16.50 -.....	16.50 -.....	16.50 -.....
Tannic, tech., bbl., lb.	.71 - .73	.71 - .73	.71 - .73
Tartaric, powd., bbl., lb.	.70 -.....	.70 -.....	.70 -.....
Tungstic, bbl., lb.	nom	nom	nom .....
Alcohol, amyl	-.....	-.....	-.....
From Pentane, tanks, lb.	.131-.....	.131-.....	.131-.....
Alcohol, Butyl, tanks, lb.	.10½- .19	.10½-.....	.158-.....
Alcohol, Ethyl, 190 p'f., bbl., gal.	11.94 -.....	11.94 -.....	8.19 - 8.25
Denatured, 190 proof	-.....	-.....	-.....
No. 1 special, dr., gal. wks.	.62 -.....	.62 -.....	.60 -.....
Alum, ammonia, lump, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Potash, lump, bbl., lb.	.04½- .04¾	.04½- .04¾	.04 - .04½
Aluminum sulphate, com. bags, cwt.	1.15 - 1.40	1.15 - 1.40	1.15 - 1.40
Iron free, bg., cwt.	1.85 - 2.10	1.85 - 2.10	1.85 - 2.10
Aqua ammonia, 26°, drums, lb.	.02½- .03	.02½- .03	.02½- .03
tanks, lb.	.02 - .02¼	.02 - .02¼	.02 - .02¼
Ammonia, anhydrous, cyl., lb.	.16 -.....	.16 -.....	.16 -.....
tanks, lb.	.04¼-.....	.04¼-.....	.04¼-.....
Ammonium carbonate,powd.tech., casks, lb.	.09½- .12	.09½- .12	.09½- .12
Sulphate, wks., ton	29.20 -.....	29.20 -.....	29.00 -.....
Amylacetate tech., from pentane, tanks, lb.	.145-.....	.145-.....	.145-.....
Antimony Oxide, bbl., lb.	.15 -.....	.15 -.....	.15 -.....
Arsenic, white, powd., bbl., lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs, lb.	nom	nom	nom .....
Barium carbonate, bbl., ton	60.00 -65.00	60.00 -65.00	60.00 -65.00
Chloride, bbl., ton	79.00 -81.00	79.00 -81.00	79.00 -81.00
Nitrate, casks, lb.	.11 - .12	.11 - .12	.10½- .11
Blanc fix, dry, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt	2.25 - 2.35	2.25 - 2.35	2.25 - 2.35
Borax, gran., bags, ton	44.00 -.....	44.00 -.....	44.00 -.....
Bromine, cs., lb.	.30 - .32	.30 - .32	.30 - .32
Calcium acetate, bags	3.00 -.....	3.00 -.....	3.00 -.....
Arsenate, dr., lb.	.07 - .08	.07 - .08	.07 - .08
Carbide drums, lb.	.04½- .05	.04½- .05	.04½- .05
Chloride, fused, dr., del., ton.	18.00 -24.00	18.00 -24.00	18.00 -24.00
flake, bags, del., ton.	18.50 -25.00	18.50 -25.00	18.50 -25.00
Phosphate, bbl., lb.	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb.	.05½-.....	.05½	.05½-.....
Tetrachloride drums, gal.	.73 - .80	.73 - .80	.73 - .80
Chlorine,liquid,tanks, wks., 100 lb.	2.00 -.....	2.00 -.....	2.00 -.....
Cylinders	.05½- .06	.05½- .06	.05½- .06
Cobalt oxide, cans, lb.	1.84 - 1.87	1.84 - 1.87	1.84 - 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 -19.00	18.00 -19.00	18.00 -19.00
Copper carbonate, bbl., lb.	.19½- .20	.19½- .20	.18 - .20
Sulphate, bbl., cwt.	5.00 - 5.50	5.00 - 5.50	5.15 - 5.40
Cream of tartar, bbl., lb.	.57 -.....	.57 -.....	.57 -.....
Diethylene glycol, dr., lb.	.14 - .15½	.14 - .15½	.14 - .15½
Epsom salt, dom., tech., bbl., cwt.	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Ethyl acetate, drums, lb.	.12½-.....	.12½-.....	.12 -.....
Formaldehyde, 40%, bbl., lb.	.05½- .06	.05½- .06½	.05½- .06
Furfural, tanks, lb.	.09 -.....	.09 -.....	.09 -.....
Fusel oil, drums, lb.	.18 - .19	.18 - .19	.18 - .19
Glauber's salt, bags, cwt.	1.05 - 1.10	1.05 - 1.10	1.05 - 1.10
Glycerine, c.p., drums, extra, lb.	.18½-.....	.18½-.....	.18½-.....

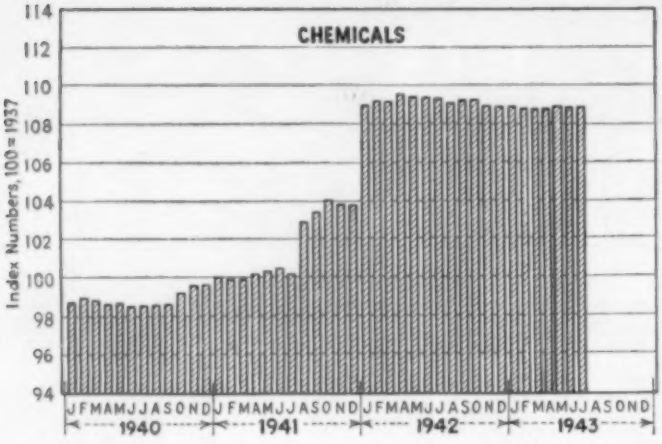
	Current Price	Last Month	Last Year
Lead:			
White, basic carbonate, dry casks, lb.	.08½-.....	.08½-.....	.08½-.....
White, basic sulphate, sck., lb.	.07½-.....	.07½-.....	.07½-.....
Red, dry, sck., lb.	.09½-.....	.09½-.....	.09½-.....
Lead acetate, white crys., bbl., lb.	.12½- .13	.12½- .13	.12½- .13
Lead arsenate, powd., bag, lb.	.11½- .12	.11½- .12	.11 - .12
Lime, chem., bulk, ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, powd., csk., lb.	.08½-.....	.08½-.....	.08½-.....
Lithopone, bags, lb.	.04½- .04¾	.04½- .04¾	.04½- .04¾
Magnesium carb., tech., bags, lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Methanol, 95%, tanks, gal.	.58 -.....	.58 -.....	.60 -.....
97%, tanks, gal.	.58 -.....	.58 -.....	.60 -.....
Synthetic, tanks, gal.	.28 -.....	.28 -.....	.28 -.....
Nickel salt, double, bbl., lb.	.13½- .13¾	.13½- .13¾	.13½- .13¾
Orange mineral, csk., lb.	.12½-.....	.12½-.....	.12½-.....
Phosphorus, red, cases, lb.	.40 - .42	.40 - .42	.40 - .42
Yellow, cases, lb.	.18 - .25	.18 - .25	.18 - .25
Potassium bichromate, casks, lb.	.09½- .10	.09½- .10	.09½- .10
Carbonate, 80–85%,calc.csk.,lb.	.06½- .07	.06½- .07	.06½- .07
Chlorate, powd., lb.	.10 - .12	.10 - .12	.10 - .12
Hydroxide (c'stic potash) dr., lb.	.07 - .07½	.07 - .07½	.07 - .07½
Muriate, 60% bags, unit	.53½-.....	.53½-.....	.53½-.....
Nitrate, bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb.	.19½- .20	.19½- .20	.19½- .20
Prussiate, yellow, casks, lb.	.17 - .18	.17 - .18	.17 - .18
Sal ammoniac, white, casks, lb.	.0515- .06	.0515- .06	.0515- .06
Salsoda, bbl., cwt.	1.00 - 1.05	1.00 - 1.05	1.00 - 1.05
Salt cake, bulk, ton	17.00 -.....	17.00 -.....	17.00 -.....
Soda ash, light, 58%, bags, contract, cwt.	1.05 -.....	1.05 -.....	1.05 -.....
Dense, bags, cwt.	1.10 -.....	1.10 -.....	1.10 -.....
Soda, caustic, 76%, solid, drums, cwt.	2.30 - 3.00	2.30 - 3.00	2.30 - 3.00
Acetate, del., bbl., lb.	.05 - .06	.05 - .06	.05 - .06
Bicarbonate, bbl., cwt.	1.70 - 2.00	1.70 - 2.00	1.70 - 2.00
Bichromate, casks, lb.	.07½- .08	.07½- .08	.07½- .08
Bisulphate, bulk, ton	16.00 -17.00	16.00 -17.00	16.00 -17.00
Bisulphite, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Chlorate, kegs, lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Cyanide, cases, dom., lb.	.14 - .15	.14 - .15	.14 - .15
Fluoride, bbl., lb.	.08 - .09	.08 - .09	.08 - .09
Hyposulphite, bbl., cwt.	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt.	2.50 - 2.65	2.50 - 2.65	2.50 - 2.65
Nitrate, bulk, cwt.	1.35 -.....	1.35 -.....	1.35 -.....
Nitrite, casks, lb.	.06½- .07	.06½- .07	.06½- .07
Phosphate, tribasic, bags, lb.	2.70 -.....	2.70 -.....	2.70 -.....
Prussiate, yel. drums, lb.	.10½- .11	.10½- .11	.10½- .11
Silicate (40° dr.), wks., cwt.	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60–62%, dr. lb.	.03 - .03¼	.03 - .03¼	.03 - .03¼
Sulphite, crys., bbl., lb.	.02½- .02¾	.02½- .02¾	.02½- .02¾
Sulphur, crude at mine, long ton	16.00 -.....	16.00 -.....	16.00 -.....
Chloride, dr., lb.	.03 - .04	.03 - .04	.03 - .04
Dioxide, cyl., lb.	.07 - .08	.07 - .08	.07 - .08
Flour, bag, cwt.	1.90 - 2.40	1.90 - 2.40	1.90 - 2.40
Tin Oxide, bbl., lb.	.55 -.....	.55 -.....	.55 -.....
Crystals, bbl., lb.	.39½-.....	.39½-.....	.39½-.....
Zinc, chloride, gran., bbl., lb.	.05½- .06	.05½- .06	.05 - .06
Carbonate, bbl., lb.	.14 - .15	.14 - .15	.14 - .15
Cyanide, dr., lb.	.33 - .35	.33 - .35	.33 - .35
Dust, bbl., lb.	.1035-.....	.1035-.....	.10½-.....
Oxide, lead free, bag, lb.	.07½-.....	.07½-.....	.07½-.....
5% leaded, bags, lb.	.07½-.....	.07½-.....	.07½-.....
Sulphate, bbl., cwt.	3.85 - 4.00	3.85 - 4.00	3.40 - 3.50

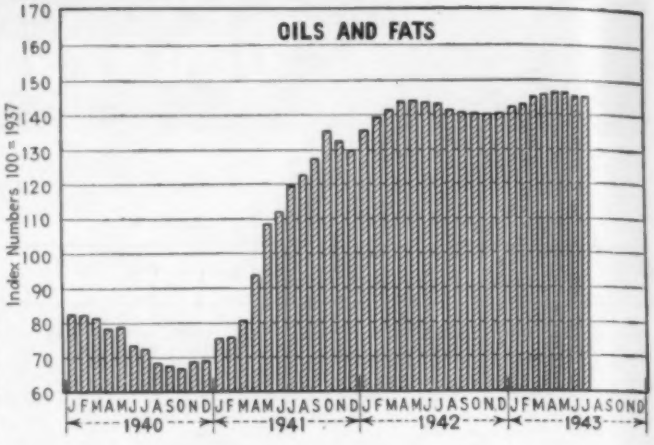
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to July 13

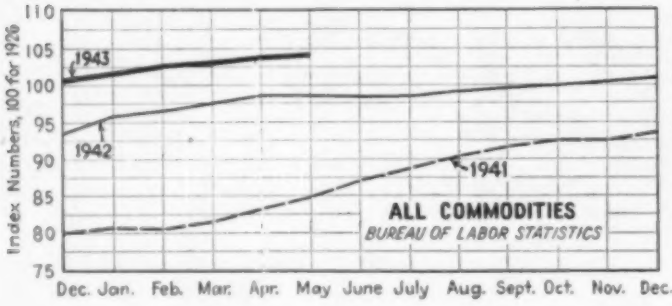
OILS AND FATS

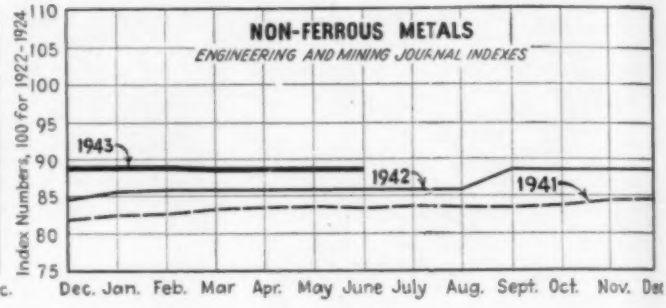
	Current Price	Last Month	Last Year
Castor oil, No. 3 bbl., lb.	$0.13½–$0.14½	$0.13½–$0.14½	$0.13½–$0.14½
Chinawood oil, bbl., lb.	.38 -.....	.38 -.....	.38 -.....
Coconut oil, Ceylon, tank, N. Y., lb.	nom	nom	nom .....
Corn oil crude, tanks (f.o.b. mill), lb.	.12½-.....	.12½-.....	.12½-.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.12½-.....	.12½-.....	.12½-.....
Linseed oil, raw car lots, bbl., lb.	.153-.....	.153-.....	.139-.....
Palm, casks, lb.	.09 -.....	.09 -.....	.09 -.....
Peanut oil, crude, tanks (mill), lb.	.13 -.....	.13 -.....	.13 -.....
Rapeseed oil, refined, bbl., lb.	nom	nom	nom .....
Soya bean, tank, lb.	.11½-.....	.11½-.....	.11½-.....
Sulphur (olive foots), bbl., lb.	nom	nom	.19½-.....
Cod, Newfoundland, bbl., gal.	nom	nom	nom .....
Menhaden, light pressed, bbl., lb.	.117-.....	.117-.....	.114-.....
Crude, tanks (f.o.b. factory) lb.	.088-.....	.088-.....	.088-.....
Grease, yellow, loose, lb.	.08½-.....	.08½-.....	.09295.....
Oleo stearine, lb.	.09½-.....	.09½-.....	.09½-.....
Oleo oil, No. 1	.11½-.....	.11½-.....	.11½-.....
Red oil, distilled, dp.p. bbl., lb.	.11½-.....	.11½-.....	.12 -.....
Tallow extra, loose, lb.	.08½-.....	.08½-.....	.097125....

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52- $0.55	$0.52- $0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.15 - .16	.15 - .16	.15 - .16
Aniline, salts, bbl., lb.	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb.	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb.	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb.	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb.	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal.	.15 -.....	.15 -.....	.14 -.....
Beta-naphthol, tech., drums, lb.	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb.	.11 -.....	.11 - .11	.10½- .11
Cresylic acid, dr., wks., gal.	.81 - .83	.81 - .83	.81 - .83
Diethylaniline, dr., lb.	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb.	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb.	.18 - .19	.18 - .19	.18 - .19
Dip oil, 15%, dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb.	.60 -.....	.60 -.....	.70 -.....
H-acid, bbl., lb.	.45 - .50	.45 - .50	.45 - .50
Naphthalene, flake, bbl., lb.	.07 - .07½	.07 - .07½	.07 - .07½
Nitrobenzene, dr., lb.	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb.	.47 - .49	.47 - .49	.47 - .49
Phenol, U.S.P., drums, lb.	.10½- .11	.10½- .11	.13 -.....
Picric acid, bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal.	1.70 - 1.80	1.70 - 1.80	1.70 - 1.80
Resorcinol, tech., kegs., lb.	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb.	.33 - .40	.33 - .40	.33 - .40
Solvent naphtha, w.w., tanks, gal.	.27 -.....	.27 -.....	.27 -.....
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal.	.33 -.....	.33 -.....	.32 -.....
Xylol, com., tanks, gal.	.26 -.....	.26 -.....	.26 -.....

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.21 - .23½	.21 - .23½	.15- .17
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335- .30	.0335- .30	.0335- .30
Prussian blue, bbl., lb.	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb.	.11 - .26	.11 - .26	.11 - .26
Chrome green, bbl., lb.	.21½- .30	.21½- .30	.21½- .30
Carmine, red, tins, lb.	4.60 - 4.75	4.60 - 4.75	4.60 - 4.75
Para toner, lb.	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb.	3.05 - 3.10	3.05 - 3.10	3.05 - 3.10
Chrome yellow, C.P., bbl., lb.	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 - .10	.08 - .10	.08 - .10
Gum copal Congo, bags, lb.	.09 - .30	.09 - .30	.09 - .30
Manila, bags, lb.	.09 - .15	.09 - .14	.09 .15
Demar, Batavia, cases, lb.	.10 - .22	.10 - .20	.10 - .22
Kauri, cases, lb.	.18 - .60	.17 - .60	.18 - .60
Kieselguhr (f.o.b. mines), ton.	7.00 -40.00	7.00 -40.00	7.00 -40.00
Magnesite, calc, ton.	64.00 -.....	64.00 -.....	64.00 -.....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 = 07
Imported, casks, lb.	nom	nom	nom .....
Rosin, H., 100 lb.	4.20 -.....	4.09 -.....	3.73-.....
Turpentine, gal.	.73½-.....	.73½-.....	.65½-.....
Shellac, orange, fine, bags, lb.	.39 -.....	.39 -.....	.39 -.....
Bleached, bonedry, bags, lb.	.39 -.....	.39 -.....	.39 -.....
T. N. bags, lb.	.31 -.....	.31 -.....	.31 -.....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
200 mesh (f.o.b. Ga.), ton.	6.00 - 8.00	6.00 - 8.00	6.00 - 8.00

Industrial Notes

DIAMOND ALKALI CO., Pittsburgh, has appointed the Miller Machinery and Supply Co., Jacksonville, as its distributor in eastern and northern Florida.

THE AMERICAN FLANGE & MFG. CO., INC., New York, has opened an aviation department at its headquarters in Rockefeller Plaza. The new department is headed by T. H. Chamberlain.

GENERAL ELECTRIC CO., Schenectady, N. Y., has made R. M. Cherry assistant manager of its industrial division.

COCHRANE CORP., Philadelphia, has appointed the Metrol Co., 2970 West Grand Boulevard, as its flow meter representative for the Detroit area with Bushnell Controls & Equipment Co., 117 West Ninth St., Los Angeles, handling sales in California, western Nevada, and Arizona.

AMERICAN BRAKE SHOE CO., New York, has made John W. DeLind, Jr., director of exports to direct post-war expansion in overseas markets.

THE COOPER-BESSEMER CORP., Mount Vernon, Ohio, has advanced Carl H. Vaupel to the position of assistant general manager of the local plant and also of the plant at Grove City, Pa.

INDUSTRIAL OVEN ENGINEERING CO., Cleveland, has added Glenn C. Paxton to its staff in the capacity of production manager.

THE ARO EQUIPMENT CORP., Toledo, has appointed H. B. Jameson division manager of the New England territory with headquarters at 52 Harvard St., Boston.

H. K. PORTER CO., INC., Pittsburgh, has purchased the Quimby Pump Co. with plants at Newark and New Brunswick, N. J. and will operate them as a Porter division.

BALDWIN LOCOMOTIVE WORKS, Philadelphia, has named V. H. Peterson assistant to the president. For the past two years Mr. Paterson had served as vice-president of the Elliott Co.

LUDLOW VALVE MFG. CO., Troy, N. Y., has added P. R. Greenman to its staff in Chicago to serve as industrial sales engineer.

AMERICAN MACHINE AND METALS, INC., East Moline, Ill., has appointed C. H. Wallace sales manager of the Tolhurst centrifugal division.

E. I. DUPONT DE NEMOURS & CO., Wilmington, has acquired the Patterson Screen Co. of Towanda, Pa., and will operate it as the Patterson screen division with Carl V. S. Patterson as manager.

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- Isopropanolamine
- Diisopropanolamine
- Methyldiethanolamine
- Dimethylethanolamine
- Tetraethanolammonium Hydroxide
- Acetoacet-o-toluidide
- Sodium Acetoacetyl-p-sulfanilate
- Methyl Morpholine
- Ethyl Morpholine
- Phenyl Morpholine

ETHERS
- Diethyl "Cellosolve"
- Hexyl Ether
- Dimethyl Dioxane
- Benzyl "Cellosolve"

ALCOHOLS
- Ethylbutanol
- Hexanol

ESTERS
- Butyl "Cellosolve" Acetate
- Methyl "Carbitol" Acetate
- Ethylbutyl Acetate
- Diglycol Diacetate
- Glycol Diformate

ACETALS
- Methyl "Cellosolve" Acetal
- Dichlorethyl Formal
- 4-Methyl Dioxolane

ALDEHYDES AND KETONES
- Glyoxal
- Glyoxal Bisulfite
- Acetonylacetone
- Isophorone
- Dehydracetic Acid

CHLORINATED COMPOUNDS
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NEW CONSTRUCTION

	Current Projects		Cumulative 1943	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	$295,000	$390,000
Middle Atlantic	$129,000	$250,000	14,199,000	3,520,000
South	440,000	400,000	7,303,000	6,940,000
Middle West	430,000	1,150,000	8,960,000	8,685,000
West of Mississippi	50,000	40,000	12,350,000	11,045,000
Far West	40,000	.....	1,965,000	57,126,000
Canada	5,768,000	.....	10,592,000	1,127,000
Rotal	$6,857,000	$1,840,000	$55,664,000	$88,833,000

PROPOSED WORK

Ia., Sheldon—Big Four Counties Co-operative Assn., M. Stietjes, Secy., plans the construction of a soybean processing mill. Estimated cost will exceed $50,000.

Louisiana—Defense Plant Corp., Washington, D. C., plans to enlarge facilities and equipment at synthetic rubber plant. Project will be operated by Standard Oil Co. of Louisiana, North Baton Rouge. Estimated cost $440,000.

Mich., Lansing—Lansing Paint & Color Co., Lansing, plans the construction of a factory here. Black & Black, 706 Capitol Savings & Loan Bldg., Lansing, Archts. Estimated cost $200,000.

Nevada—U. S. Vanadium Corp., Fred E. Gray, Nivloc, Nev., Gen. Mgr., plans the construction of a 1,000 ton reduction plant. Project will be financed by Defense Plant Corp., Wash., D. C.

N. J., New Brunswick—E. R. Squibb & Sons, 745 Fifth Ave., New York, N. Y., plan to construct a 3 story manufacturing plant. Abbott Merckt Co., 10 East 40th St., New York, N. Y., Archts. Estimated cost $89,000.

O., Cleveland — American Magnesium Corp., A. P. Crow, Supt. Constr., 2210 Harvard Ave., will construct several additions to its plant. Malcolmson, Calder & Hammond, Inc., 1217 Griswold St., Detroit, Mich., Archts.

O., Marietta—American Pottery Co., Marietta, has leased a site on Westview Ave., and plans to construct a plant. Estimated cost $40,000.

O., Painesville—Industrial Rayon Corp., Hiram S. Rivitz, Pres., West 98th St. and Walford Ave., Cleveland, plans to construct an addition to its plant here. Estimated cost will exceed $150,000.

Pa., Pittsburgh—Seaboard Glass & Bottle Co., R. R. Underwood, Pres., 26th St. and AVRR., plans to construct a 1 story, 50 x 200 ft. warehouse.

Alta., Turner Valley—Royalite Oil Co., Ltd., 606 Second St., Calgary, plans to construct an addition to its plant here. Estimated cost $300,000.

B. C., Vancouver—Western Plastics, Ltd., 506 Rogers Bldg., recently organized, plans to construct a plant for treating and preserving fabrics of all kinds, also a woodworking plant.

B. C., Victoria—Phillips Petroleum Co., Inc., 21 Dover Green, Dover, Del., plans to construct a gas and oil refinery here.

Ontario—The Canada Linseed Oil Mills, Ltd., 2215 Notre Dame St., E., Montreal, Que., has been granted a premium by the Province of Ontario to purchase land to a value not exceeding $100,000 necessary for its actual use and occupation or to carry on its undertaking.

Ontario — Smallwood Pharmaceuticals, Ltd., c/o John F. Mahon, 25 King St., W., Toronto, has been granted a premium by the Province of Ontario to acquire land to the value of $100,000 necessary for manufacturing.

Ont., Toronto—General Plastics, Ltd., c/o J. S. Wright, 320 Bay St., plans to construct a factory for the manufacture of plastic materials. Estimated cost $40,000.

Ont., Toronto—Maple Leaf Plastics, Ltd., c/o S. M. Harris, 414 Bay St., plans to construct a manufacturing plant. Estimated cost $50,000.

Ont., Toronto — National Waterproof Products, Ltd., c/o W. E. P. DeRoche, 320 Bay St., plans to construct a plant for manufacturing and processing oiled cloth, rubberized cloth and associated products plant. Estimated cost $40,000.

Que., Drummondville—Canadian Celanese, Ltd., Drummondville, Que., plans the construction of a factory for the manufacture of plastics and chemicals. Estimated cost $5,000,000.

Que., Valleyfield—Canadian Bronze Powder Works, Ltd., 9 East Park St., is having plans prepared for reconstructing three of its buildings. Estimated cost $57,680.

CONTRACTS AWARDED

Ala., Gadsden—Goodyear Tire & Rubber Co., Gadsden, has awarded the contract for an addition to its factory to Rust Engineering Co., Martin Bldg., Birmingham. Estimated cost $100,000.

Mo., St. Louis—Laclede-Christy Clay Products Co., 1711 Ambassador Bldg., will construct a 2 story, 44½x130 ft. warehouse at its plant. Work will be done with own forces. Estimated cost including equipment $40,000.

N. J., Paulsboro—Socony Vacuum Oil Co., Paulsboro, has awarded the contract for the construction of an oil refinery to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $250,000.

N. C., Hazelwood—Dayton Rubber Manufacturing Co., 2342 West Riverview St., Dayton, O., has awarded the contract for two additions to its plant to Daniel Construction Co., Greenville, S. C. Estimated cost $200,000.

O., Painesville—Diamond Alkali Co., J. B. Biggers, Ch. Engr., Painesville, has awarded the contract for the construction of a factory to Austin Co., 16112 Euclid Ave., Cleveland. Estimated cost $1,000,000. Project will be financed by Defense Plant Corp., Wash., D. C.

Ohio—U. S. Government, Wash., D. C., has awarded the contract for alterations to plant operated by U. S. Rubber Co. to Hunkin-Conkey Construction Co., 1740 East 12th St., Cleveland. Estimated cost $150,000.

S. C., Laurens—Laurens Glass Works, Laurens, have awarded the contract for additional buildings at its plant to Daniel Construction Co., Greenville, S. C. Estimated cost $100,000.

Management

—Heart of America's Industrial Progress

In Peace and War, Management Men and Methods Steer Production on a Steady Upward Course

WHEN the Allied armada of 2,000 ships, protected by a vast umbrella of planes, struck the coast of Sicily, Axis leaders once more had reason to wonder how "that decadent, pleasure-loving America" had swung from the manufacture of automobiles, refrigerators and costume jewelry to equipments of war, and had out-produced such mighty plants as the Krupp, the Fiat and the Skoda works – and had done it so quickly.

America at war is in the lead just as it has led a world at peace. Super-performing planes are taking to the air at the present rate of nearly 100,000 per year. Ships, to carry the war to our enemies, slide down the ways at the rate of two a day. Tanks, trucks, guns, ammunition are pouring out of our "peace" plants in far greater volume than the entire Axis effort can possibly equal. War expenditures in 1943 alone will reach the staggering figure of approximately $83,000,000,000 – an amount equal to our entire national income for 1929. Added to this is the rock-bottom output of essential civilian goods – a very considerable item.

This unprecedented production is taking place while some 9,000,000 men and women, those physically best equipped, have been called to the armed forces. Many of them were taken from industry, and their loss could be repaired only by more efficient equipment and more effective methods.

Rigorous training programs had to be superimposed upon many other abnormal problems facing industry in its high-speed conversion from stoves to boats; from printing machines to guns; from automobiles to airplane engines; from fishing tackle to bomb sights.

This phenomenal task was further complicated by the need for rapid expansion. A modest machine tool industry had to be expanded to handle a volume many times its normal capacity. Steel production had to be increased by 20%, and that of aluminum and magnesium multiplied over and over. From almost nil, the demand for high octane gasoline soared to unbelievable quantities. The creation of synthetic rubber and electronic industries was necessary almost overnight.

Who deserves credit for these accomplishments? All industry! The engineers, chemists, designers, skilled workers, common laborers. But over and above all it belongs to *management.*

In industry it is mandatory to have a directive force to co-ordinate the efforts of men in the use of materials and the application of power toward the production of goods and services. The application of this directive force is the function of management, and only because we had today's kind of management were we able to transform ourselves, almost overnight, from a peace-loving nation to the world's greatest producer of implements of war. As a nation, we had been preparing for a long time to play our part in world affairs. This preparation, certainly not planned for today's objectives but none the less effective, began some four decades ago.

With the advent of the twentieth century, the character of industry in the United States, and, therefore, the character of American living, began to change. Scientific management was born. Frederick W. Taylor brought into focus and showed how to use effectively those processes and procedures upon which our present-day mass production is based. He was followed by Harrington Emerson, who made the industrial world acquainted with efficiency in manufacture and the remarkable progress to be gained therefrom in the field of production, with its consequent price reductions and wider distribution of industry's products. There followed, in industry, an alert management, a capable management, a management with vision. Without it, the work of Taylor and Emerson would have gone for naught.

It is because of this early work of management – and the extraordinary developments it produced – that the country as a whole, and particularly those employed in industry, were not over-awed by the seemingly impossible job of quick conversion to all-out war production. But let us look back four decades and examine some of those preparatory accomplishments which have proven so vital to the progress and welfare of the nation.

From 1900 to 1939 (the last pre-war year), total employment of all kinds increased 52 per cent; in the manufacturing industries alone the increase was 84 per cent. *The nation became definitely industrial.*

In 1900 the average wage earner was able to spend only 20.2 per cent of his income for things other than necessities; in 1930 his buying power for non-essentials had increased to 34.8 per cent. *The average man acquired confidence in what industry could do.*

In 1900 the average work week was 56 hours; in 1930 it was 48 hours. *The burden of production was being transferred from man to machine.*

In 1939 the United States possessed 30 per cent of the world's railroads, 72 per cent of its automobiles, 49 per cent of its telephones. *The nation's production equipment had grown to formidable proportions.*

In 1939 nearly half of the families in the United States owned their own homes, 64 million individuals carried life insurance policies and 45 million had savings accounts. National income had increased 300 per cent from 1900 and during the same period the proportion of national income paid out in salaries and wages increased from 58 to 70 per cent. And in less than this period (1914–1939) the purchasing power of the wage rate increased by 60 per cent. *There had been evolved the kind of living for which men will work – and fight.*

Since 1900, factories increased their output of goods from $11,000,000,000 to $60,000,000,000 in 1939. This increase of nearly 450 per cent was accomplished while the country's population rose only 60 per cent. In this same span of years, technological developments and improvements in methods had

increased the value added by manufacture per wage earner by 200 per cent, and the horsepower per factory worker had been multiplied by 2½. *The nation's production plant was ready to assume its gigantic wartime job.*

During this period of industrial and national evolution, management itself had changed. Prior to the advent of scientific management, our goods and services were the product of several kinds of directive activities, varying from the strictly paternalistic to the ruthless. There was little conception of the responsibility that industry now broadly acknowledges – the responsibility of trusteeship in the interest of stockholders, employees and the public – specifically; in the interest of our national economy – generally. Acceptance of this stewardship is acceptance, also, of the belief that, in the long run, no industry, and no unit of industry, that does not serve society can live.

Have the actions of management caused the times to change? Or has an alert management been successful only because it has changed with the times? Certainly, the industrial concern of 1900 would not thrive under the conditions of today. Just as certainly the new things that industry has in store for a waiting postwar world will have a far-reaching effect upon the times.

Management today seldom owns the factory or the business it manages. It is hired to perform the coordinating, directive functions. It is free to change – of itself, or with the times. Management therefore exercises its power through leadership in executing ideas . . . not through ownership.

This is the fourteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Good management can be sustained only in an environment sympathetic to its aims. It has an undeniable obligation to society, because it must be a compatible part of the social structure or be rejected by that structure as a whole.

An environment sympathetic to its aims means, also, that industry, in the very serious reconstruction period ahead, will not be at full effectiveness if it is subjected to attacks by government no matter what the underlying reasons may be – over-zealous devotion to a cause, lack of understanding or just plain politics. It was to industry – to industrial management – that the government turned when our existence as a free nation was threatened; it is to industrial management that government must turn in order to win the peace.

This statement is made in the sincere conviction that what has made America strong is industry's ability to produce consistently more and more goods and services for more and more people. It is only by actually creating them that we built up our stockpiles of the necessities of life. And it is only by creating them that we can have more of those things that make life worth while. These become available to more people as industry succeeds in getting greater output of goods and services for a given input of human energy, materials and power.

And what of the physical jobs ahead? In this country alone, there will be an immense demand upon industry to supply the things people have been unable to purchase during the war. Today the nation is wearing out not only its automobiles, refrigerators, vacuum cleaners and radios, but its very houses, its roads, railroads, and airline equipment. It is saving its money while whetting its appetite. Truly, the calls the American people will make upon industry in the postwar period will be many and insistent.

This demand can be viewed in another light. Economists say there will be 56,000,000 persons seeking gainful employment after the war. The Committee for Economic Development has estimated that $140,000,000,000 worth of goods and services will be required each year for those people. Compare that with our actual output of $97,000,000,000 worth of goods and services in 1940 when gainful employment was 46,000,000.

These future jobs will be done if industry's management is not too much hampered by government management. Management in industry performs its function in the field of *doing* things. Management in government performs its function in the field of *regulating* things. The best cooperation of the two kinds of management will be necessary in the postwar period. Certainly, too much of the regulatory kind will interfere seriously with the kind that does things.

Industrial management must improve, too. If it is too selfish, if it does not recognize definitely the trusteeship inherent in its job, if it does not understand and live up to its social responsibilities, then it will be risking all for which we are fighting. The following suggestions are made to indicate the direction that management's self-improvement can take.

Evolution in management has been too slow in some respects. Management in industry has been too prone to see the advantages in technological development while being blind to its evils. Looking at industry and social progress as a whole, there can be no doubt as to the value of technological improvement. It creates jobs. It elevates the standard of living. But that economic fact is of no satisfaction to the individual who loses his job because a new machine or a new method required one less man. By and large, this is an evil that management can do something about.

Management has been too careless of its opportunities with regard to labor. On that account the pendulum of social readjustment has swung too far. Labor has been given extensive privilege without corresponding responsibility.

Industrial management has been too slow to abandon its policy of letting the buyer beware. As a result of this, industry today is over-regulated.

Management has been too slow in recognizing its responsibility to promote the economic philosophy that a society cannot have for consumption what it does not produce. A companion educational item too long neglected is management's obligation in the field of public relations.

In these years since 1900, industrial management has been growing. Perhaps many of its experiences have been but growing pains. Management has learned, among other things, the absolutely vital need for capital at the right time and in the right amount. It has learned to use some of its earnings as "seed-money" in the introduction of new products and the use of new processes. It has learned to invest more and more in research. It has learned of the interdependence of industry and agriculture. And it has learned much about the eternal triangle of industry, labor and government.

With such a history and such experiences behind it, I have every faith that management is going ahead to even more glorious accomplishments in the winning of the war, and I believe that its peacetime accomplishments to come are beyond the prediction of any of us – even management itself.

James H. McGraw, Jr.

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